An investigation of teaching and learning methods in information technology: a case study at a selected high school in Kwa-Zulu-Natal

by

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DECLARATION

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I declare that the dissertation: *An investigation of teaching and learning methods in Information Technology: a case study at a selected high school in Kwa-Zulu Natal* is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

I further declare that I submitted the dissertation to originality checking software and that it falls within the accepted requirements for originality.

I further declare that I have not previously submitted this work, or part of it, for examination at Unisa for another qualification or at any other higher education institution.

01/10/2019

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SIGNATURE DATE

OSEI-ASIAMAH JOEL

DEDICATION

I dedicate this dissertation to God, the Almighty, my lovely parents

Mr and Mrs. Asiamah and my late brother, J.K. Mensah.

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ACRONYMS

ICT	Information Communication Technology
IT	Information Technology
CAT	Computer Applications Technology
UNESCO	United Nations Educational, Scientific and Cultural Organization
FET	Further Education Training
RSA	Republic of South Africa
DVDs	Digital Versatile Discs
CDs	Compact Discs
RSS	Rich Site Summary
DoE	Department of Education
DoBE	Department of Basic Education
NCS	National Curriculum Statement
CAPS	Curriculum and Assessment Policy Statement
ICR	Intelligent Character Recognition
WWW	World Wide Web
ZDP	Zone of Proximal Development

ABSTRACT

The Information Technology (IT) as subject taught in South African secondary schools is considered to be a very perplexing subject. The IT as a subject has four learning outcomes which are E-Communication (weight 10%), Social and Ethical Issues (weight 10%), Hardware and Systems Software (weight 20%) and Programming and Software Development (weight 60%). The Programming and Software Development enjoys the highest weight as outcome of IT and it is believed to be the main cause of the difficulty of IT. The number of Grade 9 learners willing to offer IT as a subject in Grade 10 is decreasing and the number of learners pursuing IT until Grade 12 is declining in every school in South Africa annually. The aim of this research is to investigate methods that enhance teaching and learning Information Technology at a selected high school focusing on Grade12 learners. Although this work investigated many teaching and learning methods, it has come to be known that the hybrid system or method is the best to adopt and apply in teaching and learning of IT in high schools especially in the relevant target high school. Thirty (30) participants were sampled. Three (3) data collection instruments, which were questionnaires, interviews and observations were used. Results that were obtained from the use of these data collection instruments were recorded and analysed. Results from these instruments were compared and conclusions drawn. A major finding was that the hybrid system that combines both teacher-centered and learner-centered teaching approaches was able to enhance the teaching and learning of IT.

KEY TERMS:

Information Technology

Information and Communication Technology

Hybrid system

Teacher-centered approach

Learner-centered approach

Infrastructure

Instructional material

Computer Application Technology

Behaviourism

Constructivist theory

Connectivism

Computer Aided Instructions

Web based videos

Empirical inquiry

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CHAPTER 1: INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

Technology is a powerful tool for change that can bring about a tremendous transformation to the way industries, businesses, educational institutions and organisations operate. Information Technology (IT) involves the use of computers to store, retrieve, transmit, and manipulate data, or information, often in the context of a business or other enterprise. IT is considered to be a subset of Information and Communications Technology (ICT). Information Technology in education refers to all the various available technological tools that make teaching and learning in the classroom comprehensible, feasible and interactive.

Information Technology (IT) is one of the 29 school subjects included in the National Curriculum Statement of the South African Department of Education, offered at secondary school level from Grades 10 to 12 (DoE NCS, 2003 & CAPS,2011). IT includes problem-solving activities that require logical thinking, information management and communication.

IT professionals are responsible for designing, developing, supporting and managing computer hardware, software, and information networks, including Internet. In classroom teaching and learning processes, the use of ICT is imperative as it affords the instructors and learners the opportunity to operate, store, control and retrieve data other than to promote self-regulated and active learning (Ali, Haolader & Muhammad, 2013).

ICT-based learning includes an expanded propensity towards collaborative learning among learners and instructors, not just in a specific classroom. This kind of collaboration is in contrast to the conventional learning environment, for example, distance learning inspires educators and learners to engage in learning even after school time (Ali, Haolader & Muhammad, 2013).

IT in South African secondary schools have earned a reputation as a difficult subject, because of the difficulty learners experience in understanding programming (Havenga & Mentz, 2009; Jacobs & Sewry, 2009). Learners either avoid the subject IT or many learners that do attempt the subject change to another, “easier” subject such as Computer Applications Technology (CAT) before Grade12, (Koorsse, Carlitz & Cillers,

2010). The lack of interest in the subject and the negative impression created amongst learners affect the number of learners wishing to pursue a career in computer science or IT-related professions (Havenga & Mentz, 2009). This follows the trend of a decline in interest in computing professions globally over the past 10 years (Babin, Grand & Sawai, 2008; Jacobs & Sewry, 2009).

This research seeks to put in place possible measures to improve the effectiveness of teaching and learning of Information Technology and boost the interest of learners to pursue IT. This part of this research provides a brief introduction to the topic of study and deals with the following: background to the study, statement of the problem, purpose of the study, objectives and significance of the study.

1.2 BACKGROUND OF THE STUDY

The target High School is one of the few schools in the Amajuba District, Kwazulu Natal that offers IT as a subject in Grade 10 to Grade 12. This school has an enrolment of over 1500 and has less than 200 learners offering IT. It is one of best schools in Kwazulu Natal with a high percentage pass rate in matric each year, but does not perform too well in IT as compared to Mathematics, Physical Science and other subjects regarded as more challenging.

This study focuses to address the matter, specifically investigating on the methods of enhancing teaching and learning of IT in this school. IT has a major role to play in forming the new worldwide economy to deliver fast changes in society (Hussain, Suleman, Din & Shafique,2017) ICT acts as the primary foundation of the contemporary world; consequently, Technology and its fundamental concepts are considered as part of the core of education (UNESCO, 2002a). Technology has the potential to renovate the ways of instruction, where and how learning occurs and the roles of learners and educators in the instructional process (UNESCO, 2002b).

Educational institutions may utilise ICT to enrich the students with skills and knowledge for the 21st century (Andoh, 2012), to such an extent that it can add to worldwide accessibility to education, educational equality, broadcasting of quality teaching learning

programmes, educators' professional growth and to help in obtaining a more effective educational management. Hence, accessibility, inclusion and standard being the key issues of education, can be comfortably addressed through ICT. ICT improves the standard of education by encouraging learning through ongoing discussion, delayed time discussion, directed instruction, self-learning, critical thinking, data seeking and analysis (Yuen, Law & Wong, 2003). Utilisation of ICT can enhance outcomes, instruction, administration and create important abilities in the underprivileged groups (Sharma, 2003), and simultaneously influence educational instruction and research process (Yusuf, 2005)

1.3 STATEMENT OF THE PROBLEM

Teachers display an inability to use the demonstration method or activity-based method, and indulge themselves in applying the traditional method, which has made teaching the subject IT more teacher-centered instead of learner-centered. This has discouraged learners in studying IT as a subject.

Learners' enrolment for IT keeps on dropping each year, and many learners change subjects along the way before entering the final year (Grade 12). The problem under study in this study is the poor academic performance of Grade 12 IT learners of the target High School since the learners in question score poor marks in tests and exams. At the end of the term marks achieved in examinations, assignments and tests are submitted to the District Education Office quarterly. The matric results' analysis of the school from 2015 up to 2018 testify to the fact that learners do not perform well in IT.

The implementation of IT outcomes of the teaching and learning of IT as a subject in the target High School has not been fully achieved despite the fact that government and many non-governmental organisations that matter on Educational policies, emphasise IT as a tool to development.

There is little or no focus on the development of the teachers' abilities to select strategies that will minimise learners' challenges in respect to the achievement of learning outcomes. At the target High School, it is obvious that teaching and learning only emphasises the knowledge of the final result. It ignores the need to educate the learners to look at the entire process of how knowledge is acquired and which methodology is

used. Moreover, the teaching and learning aids, the school environment, the role of parents, students' interest and administrators' contribution all play a role in the learners' successful academic IT performance.

Both learners and teachers of IT in the target High School, clearly support the assertion that the teaching and learning of the subject IT is very abstract and lacks the necessary tools to enhance its effectiveness.

1.4 PURPOSE OF THE STUDY

This is conducted to ensure that appropriate measures are put in place for effective teaching and learning of IT. This research seeks to put in place possible measures to improve the effectiveness of teaching and learning of IT as a subject among Grade 12 learners. In addition, it will consider the importance of IT in education. The research will also look at the Government's role in the teaching and learning of IT. It will look at the various methods in the teaching of IT.

The study will consider the role of IT experts in education. Moreover, the environment of the teaching and learning of IT in the target high school will be dealt with. The study will concentrate on the role of the key stakeholders of FET education such as learners, parents, teachers and the government among others, in the improvement process.

1.5 RESEARCH QUESTIONS

The following questions guided the study to improve effective teaching and learning of IT in FET education:

- What methods of teaching can be employed in the teaching and learning of Information Technology in FET?
- What are the perceptions and experiences of Grade 12 learners about the pedagogical skills of teaching and learning of IT?
- How can active methods of teaching, perceptions and experiences of teachers improve the pedagogical skills of teaching in the teaching of IT?

1.6 AIMS AND OBJECTIVES OF THE STUDY

The main aim of the study is to determine or investigate the methods of teaching employed in the teaching and learning of IT in FET.

The aim of the study will be achieved by the following specific objective. The objectives were to:

- determine methods of teaching that can be employed in the teaching and learning of IT in FET;
- determine the perceptions and experiences of Grade 12 learners about the pedagogical skills of teaching and learning of Information Technology;
- find out how active methods of teaching, perceptions and experiences of teachers and Grade 12 learners can improve the pedagogical skills of teachers in the teaching of Information Technology.

1.7 SIGNIFICANCE OF THE STUDY

The study would make it possible for both learners of IT and teachers of the subject to know the importance of IT in education. It will also increase the effective use of Information Technology in education. It will also serve as a guideline for the IT teachers particularly to know teaching strategies to use and the key players of IT education in secondary schools.

Furthermore, the finding will serve as a record for the IT department to be used to improve the teaching and learning of Information Technology. Last but not the least, it is hoped that the findings will enable learners to know the prospects in IT in order to sustain their interest in the subject.

1.8 LIMITATIONS OF THE STUDY

The research cannot be completed without taking a critical look at certain factors that make it difficult to study in one way or the other. There were some constraints, which were potential setbacks to the study. The study is not able to target the entire

population of Grade 12 learners offering IT as a subject. It limits itself to Grade 12 not the entire Further Education and Training (FET) band offering the subject.

Resources such as time and resources constitute the main obstacles to the wide nature of the study. Combining study with work makes it difficult to gather effective information and data collection. Some questions administered were not responded and returned; some respondents refused to be interviewed. Some respondents gave inaccurate responses for lack of understanding to questions and not all respondents considered the questionnaire important.

1.9 DELIMITATIONS OF THE STUDY

Creswell (2003) describes delimitation as a means of limiting the scope of a study. The research emphasises the improvement of the effective teaching and learning methods employed among Grade 12 learners of a specific High School.

This study has the following delimitations assigned to focus the study within a manageable framework:

- The finding of the study could not cover all the learners in Grade 12 offering IT in FET. Moreover, to derive specific results and for critical study, only 27 learners in Grade 12 IT were sampled for the exercise. This was done to ensure validity of the results of the work;
- Other researchers who would like to do research on this problem could use the same grade from different schools to achieve similar results; and
- More techniques could also be employed for effective results, since the ones employed here are only questionnaires, interviews and observations.

1.10 ORGANISATION OF THE STUDY

The research consists of five main chapters. Chapter 1 highlights the introduction that includes the background of the study, statement of the problem, purpose of the study, limitations of the study, delimitations of the study and it ends with the organisation of the study. Chapter 2 dwells on the literature review, in which issues of other authors are reviewed to provide the theoretical and empirical basis for the study. Chapter 3 discusses the methodology which comprises the introduction, research design, population and

sampling, data collection instruments, data collection procedures and data analysis. Chapter 4 presents the results or findings and discussions of the study. Chapter 5 covers the summary, conclusion and recommendation of the study including some suggestion for further research.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

This section delves into the relevant literature on the topic of research. Given the research problem or the research questions, it is important to evaluate past and current research and the view of scholars on different aspects touched on. In this regard, this section focuses on the current teaching methods, providing insight into what methods have been successfully applied in classrooms to encourage learner participation and focuses on the knowledge of teachers in the selected subject. It was also imperative to focus on determining the growth and status of IT education in our schools. This develops a good starting point for determining the status of IT teaching and learning approaches. At the same time, this highlights insight on the merits of studying IT. This section will also look at present learning theories. Moreover, it is important to determine which theory is best suited to develop IT teaching practices. This section will end with a conclusion that highlights the main observation on the highlighted areas.

2.2 THEORETICAL FRAMEWORK OF THE STUDY

Engagement theory served as theoretical lens and provided a framework for technology-based teaching and learning. Engagement theory has emerged from the authors' experiences teaching in electronic and distance education environments (Kearsley & Schneiderman, 1998; Shneiderman, Alavi, Norman, Borkowski, 1995).

The fundamental idea of engagement theory is that learners must be meaningfully engaged in learning activities through interaction with others and worthwhile tasks. While, in principle, such engagement could occur without the use of technology. Furthermore, we believe that technology can facilitate engagement in ways which may be difficult to achieve. So, engagement theory is intended to be a conceptual framework for technology-based learning and teaching. Although not directly derived from other theoretical frameworks for learning, it has much in common with such frameworks. For example, with its emphasis on meaningful learning, it is very consistent with constructivist approaches. Because it emphasises collaboration among peers and a community of

learners, it can be aligned with situated learning theories. Because it focuses on experiential and self-directed learning, it is similar in nature to theories of adult learning.

According to Piaget (1971), from the cognitive constructivist perspective, learning is not a passive transmission of knowledge from the teacher to the learner. It is an active construction process in which learners take knowledge, transform and connect it to previously assimilated knowledge and make it theirs by constructing their own interpretation and meaning. Thus, learning is far more diffuse than the mere acquisition of explicit knowledge. This view of learning as construction is similar to Levi-Strauss's concept of "bricolage" or tinkering, a "science of the concrete". Bricoleurs's concepts embrace theories by arranging and rearranging a set of well-known concrete materials (Levi-Strauss, 1962). These concepts sit well with the view of IT as a practical subject.

2.3 THE IMPACT OF INFORMATION TECHNOLOGY ON EDUCATION

Okoro and Ekpo (2016) note that there has been an extraordinary call for the use of ICT in instructional and learning processes both locally and internationally. Salehi and Salehi (2012) state that the incorporation of ICT in instructional processes is believed as a medium in which a number of methodologies and pedagogical theories might be implemented; however, ICT as a teaching aid is more difficult and multifaceted as it needs positive attitude from the educators.

Jager and Lokman (European Conference on Education Research, Lahti 22-25 September 1999) state the impact of IT. What learners learn depends on the type of education and the level they attained. Education prepares learners for the use of IT in schools, future occupation and social life.

ICT as an ''assisting tool'' – Information Technology is used as a tool, for example, doing assignments, collecting data and documents and communicating and conducting research. Typically, it is used dependently from the subject matter.

IT as a medium for teaching and learning refers to IT as tool and medium through which teachers can teach and learners can learn. It appears in many different forms, such as drills and practical exercises, simulations and educational networks. It is also a tool for

organisation and management in schools (Kommers & Moonen, 1995; Pilot, 1998; & SER, 1998).

Jager et al. (1999) concur with the aforementioned researchers by emphasising the value of using a variety of teaching methods. It is important that learners, parents, teachers, school administrators, IT experts and Government know these and other influences of IT.

2.4. APPLICATION AND IMPORTANCE OF INFORMATION TECHNOLOGY

Lesufi (2016) a Member of the Executive Council for Education in Gauteng, focused on the role of IT or the role of computer literacy education in South Africa. He elaborates on the importance of technology in revitalising the economy and preparing the future workforce for a work environment that will rely on technology for communication. He underscores that it is impossible to survive without adequate technological education. The lack of the necessary technological education in South African schools is likely to lead to a population of jobless citizens who may have degrees but who are ill-prepared to support families and contribute to the economy.

Technology is seen in Gauteng as one investment that must be done in order to transform and reorganise schools that have traditionally been labor reservoirs in zones of hope, development and transformation. Transformation is important, because it is the only way that the current learners can be prepared for a complex and a technologically dependent society. The world is unlikely to move away from technology; therefore, children must be sensitised about the importance of technology; they must be encouraged to start thinking about the application of these skills in their future careers and vocations. The skills imparted to these children are not only important for survival in a technologically-oriented world. The same skills are an investment in improving the state of technology in this country. This is because these children are able to contribute ideologically to improvement and creation of relevant technology capable of addressing problems unique to this country. It is unlikely that foreigners will understand or develop tailor made technology solutions to the problems we face as a country. The solutions to these problems can only be solved by individuals who have experienced these problems first-hand and, as of a direct consequence, have the requisite technological knowledge. Proper introduction and teaching of IT in high schools is the first step in building the

capacity of learners and increasing their ability to develop solutions that hamper technological progress of the country.

A study commissioned by Stanford University (2014) focusing on the impact of education on learners explained that technology when implemented properly, can produce significant gains in learner achievement and boost engagement, particularly among learners most at risk. Most learners who come from regions or income groups that are considered to be at risk are unable to access quality technology education. The result has always been that learners from these risk groups or regions are disadvantaged when it comes to developing requisite or relevant work skills. The report addresses the issue of replacing teachers with technology to which the report identifies that this is not a successful formula. The effective formula involves pairing technology with classroom teachers who avail real-time support and encourage learners. Teachers must be trained on how to leverage technology to improve their teaching skills and determine how they can best teach learners the necessary technology skills. The most important connection made in the report is learner knowledge and use of technology and their chance for future progress. The report identifies that low-income teens and learners of colour are less likely to possess computers and access Internet as compared to their peers from high income families. Due to this limitation these learners were twice likely, 56 percent versus 21 percent, to lag behind in class (Stanford University, 2014).

Learners in high poverty areas were highly unlikely to access necessary technological tools that would equip them with the appropriate skills to make them technologically literate and hence, economically competitive (Stanford University, 2014). Poor technology introduction is also seen to present similar challenges that is poorly developing or improving the preparedness of learners for future opportunities. The report identified that application of technology in low-income schools will involve a “drill and kill” strategy in which computers take over the role of teachers and learners are overwhelmed with information which they should mechanically memorise and are then presented with multiple choice examinations. This is incomparable to schools with better resources where learners are immersed in a more interactive environment in which material is tailor-based on the needs of the learner and teachers prepare well thought instructions, because they are well prepared, trained and are also adequately equipped (Stanford University, 2014). Ultimately, successful teaching of technology, capable of improving

learner preparedness to a competitive job market requires access to appropriate technology that should be thoughtfully applied without bias, based on firstly, where these learners come from. Secondly the teachers must be well trained on how to teach technology and use it in giving instructions and lastly, they must have access to well equipped, adequate computers.

Another important contribution to the need or demand of better IT education is given by the Organization for Economic Cooperation and Development (2015) the report identifies the fact that disparities in access and proficiency in ICT among socio-economically disadvantaged groups have been a major factor contributing to the status quo. The term “digital divide” has been developed to explain the fact that there is likely to be disparities that threaten social and national cohesion, as they limit adequate participation in work and decrease political efficacy for certain sections of the population that lag behind on the analogue side of the divide. A digital divide may arise due to a number of factors; the first of which is poor facilitation, lack of equipment or poor instruction. Bridging the digital divide requires concerted efforts from the government from teachers the community as well as private sector players. Technology avails multiple opportunities which include and are not limited to civic participation, networking or improving productivity at work. Furthermore, unequal distribution of material or poor technology instruction limits chances of tapping into these opportunities and as a result may actually intensify existing status differences.

Livingstone (2012) explains digital inequality as difference in the material, cultural and cognitive resources that are needed to capitalise on using ICT. Most studies focused on the digital divide have dwelt on physical access and availability of ICT tools, while explaining the fact that ownership is one of the factors that explain optimisation of technology. The digital divide also addresses other aspects like how updated the available material is or the generation of computers adopted in these areas. In recent years, the focus has shifted to preparedness, and the instruction and level of computers used to teach ICT are seen to affect the preparedness of learners for future civic, social and economic roles. This has driven countries to invest in technology and at the same time focus on instruction. Investment in technology is seen as the means of improving the plight of disadvantaged children from poor economic backgrounds (Organization for Economic Cooperation and Development, 2015). As a result, equipping schools and

improving teaching abilities is an important step in closing the digital divide. It is important to improve teaching methods and the status of technology by also incorporating technology in learner learning in order to close visible economic and social gaps in the country.

2.5 STATUS OF INFORMATION TECHNOLOGY STUDIES IN SOUTH AFRICAN HIGH SCHOOLS

Padayachee (2017) citing the Department of Basic Education, RSA Action Plan to 2019 report, acknowledges that technology-enhanced learning in South Africa has not advanced as initially expected. The report cites that there is a gap between government plans and expectations and teachers' practice. The status of e-learning has in turn dragged the adoption of technology studies. This is because it is ineffective teaching learners' aspects that have not already been adopted in the classroom setting. Therefore, it is difficult to research the extent of IT teaching in South African whereas ignoring the extent to which the South African education system has adopted technology studies. The two are expected and should follow a linear scale. Nonetheless, the current challenges notwithstanding, its education in South Africa schools is based on two goals; developing digitally enabled citizens and bridging the digital divide. In order to achieve these goals, the following six areas have been identified as the core study areas or units in the South African IT course (DoE NCS,2003 & CAPS, 2011). The six areas are: Solution Development, Communications Technologies, Internet Technologies, Systems Technologies, Data and Information Management and Social Implications. The six areas are developed with the specific desire or intention of the learner to apply appropriate techniques and procedures to plan solutions and devise algorithms to solve problems using the requisite techniques and tools. The second aim is to help learners understand and apply the appropriate communication technologies for information dissemination. Moreover, it is crucial to appreciate and understand different systems and technologies applied in developing a computer system. All ICT systems are based on software engineering principles that all form an integral part of technology. It is also imperative to understand and constructively apply the Internet for different and important tasks and understand and be able to practise different concepts of data and information management to comprehend how knowledge-driven society is able to run. Lastly, the

idea is to comprehend the social effects of IT and how IT can be handled or applied responsibly (Padayachee, 2017).

According to the Institute of Information Technology Professionals (2012) the status of IT education in South Africa cannot be understood without a look at the history of computer education in South Africa. IT as a subject started as Computer Studies in 1979 taught in the Western Cape, South Africa. The current form or the current content has evolved from this initial subject in response to changes in the technological world and adoption of responsive school curriculum. The evolution of IT studies in the country for the past 4 decades is expected to have made South Africa a hub of technology. At least in reference to IT education, however Fambaza (2012) explains that this is not the case. Despite the plan by the government to equip learners with new technological skills that are highly relevant in the modern world this is yet to become a reality in most of the South African schools. Fambaza (2012) explains that very few schools in the rural areas offer Computer Applications Technology. Even the few schools that offer this class face numerous challenges, one of them being a lack of electricity. The importance of computer or IT studies cannot be overemphasised, the course or this form of education is highly critical in preparing the learners for better performance when they join tertiary institutions.

Referring to teachers, Fambaza (2012) explains that teachers especially those in the rural areas lack a functional Computer Literacy foundation on which to develop new technology and skills. This problem is linked to the fact that computer studies or computer literacy skills were not part of most teachers' own educational environment. The number of years of experience and the teacher's knowledge in a computer-based environment is largely influential in ack of relevant knowledge or lack of familiarity with Computer Technology which includes knowledge in; hardware and software. The situation is exacerbated by a lack of sufficient education or training opportunities and overpopulated classrooms. The teachers are also faced with the challenge of insufficient education or instructional material; corresponding challenges include insufficient technical assistance and a shortage in the number of computers available for learners.

Padayachee (2017) identifies that most teachers joined the teaching profession with art-based qualifications. The government, in introducing or advocating for adoption of technology education in schools, ignored the fact; the DoBE has also failed to identify

that introduction of computers or IT education is a process that requires time to become self-generating with younger teachers who have become acquainted to the use of computers and understand the important of IT in child development. Institutions which have received computers are facing maintenance of these computers. As a result, it has become very difficult to find a school with a functional computer laboratory. This is because there is a lack of technical staff to maintain or support computer-based education in schools. The biggest challenge at present is the issue of teachers. Researchers argue that it is important for the DoBE to employ teachers who are well trained in Computer Applications Technology at high school. Going back to the development of appropriate teaching approaches and strategies it is impossible for teachers to develop an effective learning approach if they do not have the basic training or understanding of the subject. Therefore, the question of IT teaching or enhancing learning of information technology in high schools must be accompanied by an investment in the teaching personnel Fambaza (2012). The current challenges on personnel and equipment is highly likely to impede the success of any teaching strategies or methods, no matter how good or how practical these methods have been proven to be in actual practice.

2.6 ENHANCED TEACHING METHODS

According to Ganyaupfu (2013) the main goal in teaching is to bring about fundamental change in the learners. In order to allow the process of knowledge transmission, teachers should use proper or appropriate teaching methods that are fitting of the objectives and level exit outcomes. Traditionally, teachers widely applied teacher-centered methods to pass knowledge to learners compared to learner-centered methods. Up to date, there has been an overwhelming interest on effective teaching methods. The desire is to establish the impact of different teaching methods on learners' learning and growth. In the specific realms of information technology, there is a wide gap on what constitutes or represents effective teaching methods given that the field is relatively new. IT is an important educational field in the current world; however, if it is not taught properly as a result of applying redundant or ineffective teaching methods, it is unlikely for the learners and the country to realise the full potential of this specific field. Ganyaupfu (2013) observes that poor learner performance in majority of learners has always been linked to application of ineffective teaching methods; these are methods that do not efficiently impart the right knowledge on learners. Adunola (2011) explains that many studies on

the effectiveness of teaching methods point to the fact that the quality of teaching is often reflected by the achievements of learners. Teachers ought to be in a position to bring about desirable changes in learners to bring about specific outcomes. In order to develop an appropriate teaching approach or method; a teacher needs to evaluate multiple teaching strategies that identify the uniqueness the complexity of the subject to be taught.

Teaching is a continuous process that is focused on bringing about the most appropriate results by learners. In order to achieve this, the methods applied by teachers must be fitting for the subject matter. In cases where effective teaching methods are applied, learners are able to respond favourably to the subject concepts and answer related questions in a unique manner (Adunola, 2011). Teaching approaches or methods have been categorised or ranked into two: the traditional approach which is referred to as the teacher-centered methods and the contemporary approach to teaching which has been identified as learner-centered teaching methods. Concerning teacher-centered methods, it must be noted that the learners simply obtain the subject information from the teacher without building their engagement with the subject being taught. This approach is not practical and is, instead, focused on the development of the ability of the learners to memorise basic concepts and is more theoretical. The learners are not engaged in different activities that would encourage them to identify different problems in real life and develop specific solutions to these problems. The teacher is in absolute control and determines how knowledge is transmitted or shared in the classroom. In order to save time and in order to develop a convenient approach, the teacher is likely to maximise the delivery of information while minimising time and effort. In practice, it is highly unlikely that the teacher would improve the understanding of learners and instead it is highly likely that the learner interest will also diminish. Identifying these weaknesses, it has been identified that a better approach that focuses on more aspects beyond dispensing rule and maximizing memorization should be developed.

In order to remedy the weaknesses developed or identified with the teacher-centered approach, a learner-centered method was developed. This is or has been identified as a supple learner-centered method that helps maximise practical teaching. The effectiveness of this method is based on the fact that the teacher is able to encourage learner interest, analytical research and critical thinking (Adunola, 2011). Nevertheless, the learner-centered approach is also keen on fostering enjoyment and fun, which is

critical in ensuring or retaining interest in the subject. The biggest support for this approach is based on the fact that it does not centralise the flow of knowledge from the teacher to the learner. The approach is also favoured as it motivates goal-oriented behavior among learners; thence the method is highly likely to improve learner performance.

Besides the two methods, a hybrid approach has been developed, identified as the teacher-learner interactive method. This method capitalises on or combines both methods in the teacher-centered and learner-centered approach (Adunola, 2011). The assumption is that the combination of both methods affords learners the opportunity to remember better and also gain a practical look at the subject. The method encourages learners to be proactive in searching for information and research as opposed to the teacher developing a monopolistic approach to the teaching exercise. Since the teacher maximises their experience and determines the most effective way of developing and imparting knowledge, they simultaneously are encouraged to research and develop a personal initiative to research. This method is regarded as the best or the most appropriate method of teaching. It capitalises on learned experience by the teacher and also encourages practical and research orientation by the learner. The effect of this process is an effective learning process and approach (Adunola, 2011). However, the debate on what method is best suited for teaching information technology in South Africa is still continuing.

The foundation of these teaching methods or approaches is largely based on traditional methods. However, IT cannot be regarded as a traditional subject, in the same class as history, sociology or even mathematics. As a result, it is likely that the determination of the best approach in teaching the subject is still ongoing (Adunola, 2011). However, it is not one search that should continue forever as there is an immediate need to develop the requisite technology skills among learners. The risk in applying the wrong approach is based on two factors as established in this section; the first risk is diminishing learner interest in the subject of IT. A related risk is poor development of the subject among learners, which means they have the wrong foundation for further pursuance in post graduate levels or as a career. The other risk is disinterest or demotivated teachers; adopting or using the wrong teaching approach is also likely to demotivate the teacher who will lose interest and then focus on only having the learners pass as opposed to

imparting them with critical actual experience and abilities to critically think through issue (Lindquist, 1995). This affects the quality of teaching and the motivation of teachers. All these effects combine to lower the standard of information technology studies or contribute to a declining interest in the subject, which should not be the case. This should and can be averted by developing the right teaching approach. This can be either of the independent approaches or a combined or hybrid teaching approach.

Lindquist (1995) in his research identified that a learner-centered approach is highly effective as it promotes great mastery of the subject, rather than centralising the flow of knowledge as a one-way channel from teacher to the learner. This was backed up by related research, which showed that teacher-centered approaches were responsible to for poor learner performance. This was compared to the teacher-learner interactive approach, which leads to increased performance of the learners. Other numerous research initiatives as cited by Ganyaupfu (2013) indicate or support the idea that a combination of teacher-centered and learner-centered teaching methods leads to the most effect approach in teaching as can be seen in learner results. This is congruent with additional findings that show that methods that promote the interaction of teachers and learners during a teaching experience end up encouraging an educationally productive environment. This cannot be compared to the result when teachers monopolise the teaching experience by making it or developing a one-way transmission channel as is the case with teacher-oriented approaches. Ganyaupfu (2013) found that the mean score recorded for learner-centered approaches was marginally lower than that recorded in a teacher-learner interactive approach. Based on this research, it is evident that in as far as teaching strategies are concerned; teaching learners by involving them is likely to lead to far better results than an approach where the teacher takes absolute control being responsible for all the teaching experiences. In the same vein, a teaching approach which ensures a full involvement of teachers and learners, and not only one party, which in this research has been identified as an interactive teaching approach, is far better than the other two approaches. The effectiveness of this approach is based on learner interest, developing critical thinking capacity, developing a practical approach and lastly making the education process both fun and enjoyable.

Gide and Wu (2010) researched effective IT teaching approaches for international learners in Australia. This study involved IT teachers with an accumulated experience of

30 years. According to the study, the goal of the teachers is to develop a teaching approach from a global perspective with the aim of producing a future professional workforce. Teaching IT is a challenging activity and in order to overcome these challenges the teachers have tended to develop a positive learning environment and adopt effective, inclusive and innovative teaching strategies. Even though the strategies adopted by these teachers consider the pedagogical differences as the learners are largely from China, the study proposes a workable approach that would be adopted to the South African context. The study identifies that the first step is to always invest in knowing the learner; knowing learners is an important step in improving the quality of education or teaching approaches. Introduction involves explaining to learners the teachers' knowledge areas and interest. On the other hand, the teachers may require the learners to introduce themselves and identify their strong points or explain any information or knowledge on the specific field.

Biggs (2003) asserts that this approach allows the teacher to prepare a course approach that is commensurate to learner needs. This encourages learners to be both physically and mentally present and encourages them to be more interactive with their teachers and other learners for class participation and discussion. The other focus for the teacher is to identify any special needs; the teachers are or should be encouraged to develop innovative teaching approaches that are backed by theoretical frameworks on the specific subject.

Teachers can inspire and motivate learners by applying a combination of innovative teaching practices and nurturing the learners' self-esteem and confidence. The other important involvement is fostering the learners' critical thinking and active learning skills.

Gide (2009) notes that IT is a practical subject and teachers must not only encourage learners to memorise concepts, but also to think critically of possible solutions. In this case, it is paramount to improve the learner's critical thinking, active and deep learning as well as problem solving skills. Equally important to learners is developing an effective teacher-learner relationship or contact in order to improve the learners' communication skills. The contact or constructive relationship between the teacher and the learners is a critical factor in the learners' learning journey. In this case, teachers who have an open-door policy are seen to bring out the best from their learners. These teachers are seen

to be very effective in encouraging problem-solving as learners are willing to reach out to them whenever they have issues or when they are preparing for presentations. This improves the quality of their output. The best teachers are not those who are available from seven to three, but those who are always available to provide the necessary feedback, support and guidance. Beyond developing open communication and encouraging interaction, a good or effective teacher is also one who is able to motivate and inspire learners by applying interactive teaching techniques such as the use of DVDs, CDs and Web based videos and tutorials (Biggs, 2003).

Safdar, Yousuf, Parveen and Bethlol (2011) conducted an experimental study to identify the effectiveness of ICT in teaching mathematics at secondary level and they found that ICT is effective in teaching mathematics as compared to the traditional teaching methods.

Ziden, Ismail, Spian, and Kumutha (2011), carried out an experimental study and concluded that ICT has a positive effect on the academic accomplishment of learners in subjects. The study endeavoured to decide the distinctions of accomplishment between the female and male respondents. The study found that male learners performed better than female learners.

Carrillo, Onofa and Ponce (2010) carried out an experimental study on IT and learners' achievement and they found that ICT has a positive effect on the achievement scores in mathematics tests, but failed to increase achievement scores in language tests.

Sackey (1994) identifies demonstration supported by explanation and answers as the best means practically oriented subjects like ICT can be taught. Sackey says that, allowing questions from learners helps them to focus and clarify points.

Sackey (1994) seeking to ensure the effective use of demonstration as a method of teaching practical oriented subjects identifies five steps as follows:

- Speech should be clear, distinct, slow and simple;

- Simple language should be used to suit the background of the learners;
- Any unfamiliar terms should be explained to learners;
- New ideas should be explained to learners; and
- Explanations should be repeated very well to suit individual learners.

Talabi (2003) argues that, the demonstration method of teaching enables the teachers to display objects in the class to help them teach a particular concept. In this case, while the teacher is carrying out the demonstration, the learners observe closely and watch teachers' actions. The teacher then pauses occasionally, lead and direct the learners to do the same as he has already done.

Tamakloe, Amedahe and Atta (1996), explain that activity-based methods of teaching have to do with getting the learner involved in the lesson and through variety of activities the teacher helps the learner to apply the necessary skills, knowledge and abilities acquired to solve problems. This implies that involving learners in teaching and learning helps teachers to convey knowledge and skills in ways that learners will understand remember and apply and gives learners the opportunity to participate actively in lessons.

Coombs (1995) states that role play is where learners act out a scene, as in a play, the teacher sets the scenes, creates a situation and the learners perform in their various roles. He further sets out some basic characteristics of this type of teaching method as it must be precise, concise and realistic. The role-play method of teaching develops the learners' imagination and bodily skills and the mind as well as understanding, warmth and sympathy towards other people.

Farrant (2002) also stresses that role play helps the learner to exercise competencies, stimulate imagination and enables experimentation beyond the real level of development

without dangerous consequences. This method of teaching helps the learners to unearth their hidden talents and also to develop their potential.

2.7 INFORMATION TECHNOLOGY (IT) AND SCHOOL LEARNING

Livingstone (2012) explains that the importance of ICT in the learning process is not restricted to improving the skill set and knowledge of the learner. It is also used in improving or increasing the quality of teaching, learning and management in schools and as a result it is important in increasing or raising the standard of education in schools. Technology's contribution to the learning process is based on ICT's capacity to "converge traditionally separated educational technologies such as books, writing, telephone, television, games among others". However, like every other technology it comes with opportunities and challenges to schools; this is because for a school to fully implement ICT it must invest in the appropriate educational infrastructures; it must train teachers on the use of technology and how to introduce technology to learners. It must revise and develop a curriculum and lastly there must be a new infrastructure that not only focuses on education and learning but also on testing and assessment.

Education policy on ICT hardware and software in schools has partly been aimed at teaching children how to use technologies; these skills are indeed important but the ambition is to apply ICT in raising the standards of education as demonstrated in exam grades and other formal means of assessment. Attaining improved education standards would help justify the huge costs and alter the infrastructure that has dominantly formed part of the education system. Fuchs and Woessmann (2004) study have shown that there is a positive correlation between learner achievement and the presence of computers at school and at home. Further, the correlation appears to fade when the presence of computers is concentrated at homes as opposed to schools. This shows that there is much greater value in concentrating on ICT and computers in school as opposed to having them in homes. The consequence is that if there is adequate investment in ICT in our schools and proper investment in building the capacity and training of teachers then there is expected to be uniform improvement in the performance and situation of learners. This is important in bridging the educational performance gap that has been witnessed across learners of different social and economic groups. Nonetheless, a simple increase in ICR provision is not enough to guarantee enhancement of the educational

performance. Lei and Zhao (2007) studied the learning outcomes of 12-13-year-olds and they found that individual grades' average only increased in subject-related technology; the improvement in individual performance was accompanied by an increase in teacher knowledge on appropriate application of the relevant technology into the respective knowledge area.

2.8 IMPROVED ENVIRONMENT FOR INFORMATION TECHNOLOGY (IT) IN THE ENHANCEMENT PROCESS

Teachers' motivation to use IT in the classroom is at present, adversely influenced by a number of constraints such as, amongst others, inadequate time to gain confidence and experience with IT. Limited access to reliable resources on the IT curriculum, an overloaded content, and assessment challenges also stunt the use of technology. Furthermore, there is a lack of subject-specific guidance for using IT to support learning. While this technology can be employed in diverse ways to support different curriculum goals and forms of pedagogy, such constraints have often stifled teachers' use of IT in ways, which effectively exploit its interactivity. Consequently, well-integrated and effective classroom use of IT is currently rare. To conclude, teachers are currently working towards harnessing the power potential of using IT to support IT learning as far as possible, given the very real operational constraints.

Further development depends on providing more time, adopting modern learner-focused techniques of teaching IT, consistent access to reliable resources, encouragement and support, and offering specific guidance for appropriate and effective use. Assessment frameworks may also need to change in order to evaluate – and thereby further encourage IT-supported learning (Steve, 1997).

2.9 THE USE OF INFORMATION TECHNOLOGY (IT) TOOLS IN THE ENHANCEMENT PROCESS

IT offers the following range of different tools for use in the enhancement process:

- Tools for data capture, processing and interpretation, data logging systems, databases and spreadsheet, graphing tools, modeling environment;

- Multimedia software for simulation of processes and carrying out virtual experiments;
- Information systems;
- Publication and presentation tools;
- Digital rewinding equipment;
- Computer projecting technology; and
- Computer controlled microscope.

2.10 INFORMATION TECHNOLOGY AND THE ENHANCEMENT PROCESS

The following suggest that use of ITs can enhance effective teaching and learning:

- Ensuring that IT's are appropriate and adds value to learning activities;
- Building on teachers' existing practice and learners' prior conceptions;
- Structuring activities while offering learners come responsibility, choice and opportunities for active participation;
- Prompting learners to think about underlying concepts and relationships;
- Creating time for discussion, reasoning, analysis and reflection;
- Linking IT use to ongoing teaching and learning activities; and
- Exploiting the potential of learners while class interactive teaching and encouraging learners to share ideas and findings (Asiedu C, 2007).

2.11 THE VARIOUS LEARNING DOMAINS IN THE ENHANCEMENT PROCESS

The researcher was delighted to consider issues concerning the different domains for IT regarding teaching and learning and pedagogical skills to improve the efficiency of the education system (Dewey, 1966; Anderson & Krathwohl, 2001).

Moreover, during the teaching and learning of IT among Grade 12 learners of the selected high school, the researcher realised that the school needs to identify different domains of learning as a stated by Dewey, Anderson and Krathwohl (2001). These domains include:

- Cognition learning;
- Cooperation learning;

- Coordination learning; and
- Collaboration learning.

2.11.1 The Cognition Learning Domain

According to Christensen and Knezek (2006) the cognition domain explains that the use of IT tools requires an understanding of how they are used in the classroom, and what learning goals are held by the teachers or educators. They further explain that the process of cognition to achieve a common goal among learners is shared.

Evidence indicates that when cognition is used effectively, technology applications can support higher order thinking. However, critical observation of the teaching and learning in the selected high school indicates that there is a lack of focus considering the kind of teaching methodology that is employed.

2.11.2 The Co-Operation Learning Domain

It was pointed out that the difference between effective and ineffective cooperative learning teams lies precisely in the combination of goals. Dewey (1966) explains that cooperative learning involves a single learner to carry out learning behaviours of all the agents. Christensen and Knezek, (2006) agree that effective cooperative learning processes depend on a combination of learners' goal preferences and the appropriate learning context. They point out that difference between effective and ineffective cooperative learning teams lies precisely in the combination of these goals.

2.11.3 The Co-Ordination Learning Domain

In regard to the coordination learning domain, Linnenbrink (2006) comments that, coordination allows those with similar motivations on performance and assessment to share their personal goals related to emotional and value development. From Linnenbrink's explanation, the researcher believes this relates to her work in the sense that, allowing enough time for individual work is of great importance to ensure that people can bring their individual domain knowledge to bear. Furthermore, it requests learners to

coordinate and agree on their activities and task strategies to solve the learning task at hand.

McCormick, (2004) identify that in collaboration learning, there is a growing tendency to stimulate learners to learn actively independently, in a self-directed way and in collaboration with others.

2.11.4 The Collaboration Learning Domain

The findings of McCormick (2004) teach that the central idea in the theme of "collaborating to learn'' and ''learning to collaborate '' revolves around that participation in technological activity. Such an activity is collaborative, and learning to participate is an important feature of learning. This supports the assertion that improving teaching and learning of IT in high schools, involves new technologies that will provide promising opportunities to make this new kind of learning possible to guide the learner in these new ways of learning.

2.12 THEORIES OF LEARNING

The introduction of computers in the classroom has shifted or changed the learning environment. This is irrespective of whether the computers are used to teach learners on different areas of ICT or they are used to automate the learning process. Irrespective of the function, there is increased interest from educators on the best approach to experience learning. There are two theories of learning; behaviorism and constructivism. These two theories have been developed by different thinkers and offer two, diverse views of learning. Behaviorism was advanced by Skinner and Watson who focused on how the interpretation of learning was affected by change in the environment. Skinner (1968) focuses on providing proof that behaviour could be predicted and controlled. On the other hand, Piaget and Vygotsky advanced constructivism. They described learning as an interactive process, during which learners search for meaning, using the help of a caregiver. In addition, the scholars developed elements that help predict the different stages of schooling. Furthermore, it involves the information that scholars are able to assimilate information during each of these stages (Ertmer & Newby, 2013).

2.12.1 Behaviorism

Ertmer and Newby (2013) identify that behaviorism equates learning with changes in either the form or frequency of observable performance. Learning is achieved when there is a satisfactory response after the use of a specific environmental stimulus. In behaviorist learning, the key elements are the stimulus, the response and the association between the two. The most important aspect is establishing how the stimulus and the response happen, and how it can be improved and maintained. The main focus for this theory is the results of performances and responses that are followed by reinforcement that all are highly likely to be repeated in future. In addition, this theory characterises learners as reactive to conditions in the environment instead of assuming active roles in understanding the environment. The environment has a direct influence on learning.

According to this theory educators assess learners and gauge at what stage they should start instruction and also define which reinforcers have the best effect for different learners. The most important factor is how to arrange stimuli and consequences within the environment (Ertmer & Newby, 2013). This theory identifies an important role of repeated instruction. This improves memory and helps the learner store important stimuli and improve the learner's readiness to respond. Another important focus for the theory is on how transfer is explained under the theory. In this case, transfer is expressed in terms of the learner being able to apply the learned knowledge in new ways or in different situations as well as being able to apply past knowledge on new learning. In this theory, transfer takes place through generalisations. A situation that involves the same elements enables behaviour to be applied across identical elements. The best types of learning expressed by this theory include those that are most appropriate in strengthening stimulus-response associations (Roberts & Potrac, 2014). These prescriptions have been passed effectively in facilitating learning that includes discriminations, generalisations and chaining. However, it has been acknowledged that behavioural principles do not adequately explain development of knowledge in complex subjects that demand a greater depth of processing such as language development and critical thinking.

This theory is not without weaknesses or gaps; these have been observed over time especially given that a bulk of instructional material for early-audio visual materials employed this approach (Ertmer & Newby, 2013). From this early experience, behaviorism has been critiqued for laying great emphasis on use of observable and

measurable outcomes in learners. The other assumption is that the theory advocates for pre-assessment of learners to determine where instruction should start. The theory also emphasises learning and understanding early steps before advancing to complex designs and concepts as well as application of reinforcement to improve learner performance, reinforcement in this case may involve rewards and constructive feedback. The last basis for the theory is the application of cues, shaping and practice to encourage a strong response to stimulus.

Those who apply behaviorism in teaching or educating organize instruction in a manner that elicits the desirable response from the learner who is presented with a target stimulus. In order to achieve this, the learner must be well aware of how to execute the proper response and also understand the proper conditions in which a response should arise (Ertmer & Newby, 2013). As a result, instructions are modelled to project the target stimulus and avail opportunities for the learner to practise the right response. In order to enable the link between the stimulus and the response, instructions often involve cues and reinforcement. The role of the teacher in this case, is to determine which cues are capable of generating the right response. Furthermore, they need to come up with the right practice which pairs the right stimuli with the anticipated or the right response and lastly arrange the environmental conditions so that the learners can generate the right responses when the stimuli is introduced and receive reinforcement for those responses. Dede (2008) explains how behaviourism can be applied in the study of ICT. The success of behaviorism is nested within the improvement or successful facilitation of the introduction of technology based on the availability of a plethora of technological tools that act as stimuli which engage learners in a learning activity in order to acquire relevant knowledge. At present, Computer Aided Instruction is widely applied, on the basis of the behaviorist theory, to teach facts and pass information linked to subject-related material. The most common applications of behaviourist theory are seen in use of CIA in developing educational games and problem resolution programs; these applications succeed or are effective because they engage the learner and avail activities, which the learner has to continually interact with until the right response is generated.

On the basis of this study, application of the behaviorism approach is still relevant in the sense that the teacher is still a major actor in the learning context. The teacher is able to determine the knowledge levels of the learners; where most learners have negligible

technological know-how and determine the best instructional material (Roberts & Potrac, 2014). The teacher goes ahead to develop the appropriate stimulus with the anticipated response being an absolute demonstration of relevant technology knowledge such as identifying different hardware and learning how to run and use simple and basic software. These performances are reinforced through the teachers' feedback, pass or failure, which reinforces the learners' observable behaviour and performance. Despite these gains, Dede (2008) observes that the behaviourist approach is a passive way of passing knowledge and that the learners' mental actions ensure the learning processes in progress are not considered. This has led educationists to move away from the behaviourist approaches to other educational theories that consider the cognitive processes of storing and retrieving information in the memory. Ertmer and Newby (2013) observe that this shift has led to an increased scrutiny on the constructivist theory which underscores productive learning. In this case, learning is not focused on merely generating a response, stimulating or reinforcing this response. Instead, learning is seen as a mental activity and there is deliberate thought that goes into developing the application of this knowledge after the learning process has taken place.

2.12.2 The Constructivist Theory

The constructivist theory is based on an understanding of knowledge as the "function of how the individual creates meaning from his or her own experiences" (Ertmer & Newby, 2013). This theory is not a new theory, like multiple other theories, but it is based on philosophical and psychological viewpoints that have gained interest over the years and which are based on the thoughts of Piaget, Bruner and Goodman. Nonetheless, the theory has only started gaining attention or popularity in recent years due to its applicability in various disciplines especially in instructional design. In accordance with this theory, learning is equated to creating meaning from human experience. To some parties, constructivism is considered to be part of cognitivism; however, it is different from classic cognitive theories (Roberts & Potrac, 2014). One of the main differences is the fact that cognitivists consider the mind to be a reference tool for the abstract world that is different from constructivists who view or look at the mind as a filter. The mind filters the input from the abstract world and comes up with its own realities.

Constructivists unlike cognitivists and behaviorists do not believe that the mind is independent and can be mapped into a learner (Ertmer & Newby, 2013). Although

constructivists do not oppose that the existence of the real world, they believe that the way we perceive the world is a result of our own experiences and interpretations. This is because the human mind comes up with meanings as opposed to acquiring these meanings from the abstract world. In this case, learners do not assimilate knowledge from the abstract world into their memories; instead they build personal interpretations on their interactions and experiences. This means that the understanding or the knowledge an individual has at present is open to change as their interactions and experiences change (Brown, 2006). Moreover, in order to determine the learning that has taken place, one must also understand the experiences of that individual.

Under the constructivist theory, learning is influenced by both the learner and the environment. Interaction between these variables results in knowledge, the underlying assumption of constructivists is that behavior is situationally determined. Content knowledge is embedded in the situation in which it is applied, in the same way that a learner understands and develops knowledge on new vocabularies through exposure and interaction with these words in context (Brown, 2006). As a result, it is critical that learning takes place in actual or relevant settings and that the selected learning tasks must be congruent with learner experiences. Based on the constructivist theory, concepts continue to evolve every time there is a new situation or activity. As a result, a learner's memory is always evolving due to the accumulated experiences. Therefore, constructivists view the retrieval of stored information in our brain and retrieval of knowledge structures as a crucial part of assisted learning. The important thing is developing learners to an extent or to a point where they are able to create novel and situation-specific understanding by applying past knowledge gathered in different instances to resolve or attend to the task at hand. The biggest interest is flexibility where learners apply pre-existing knowledge to solve problems. Ertmer and Newby (2013:56) state that "the focus of constructivists is on creating cognitive tools which reflect the wisdom of the culture in which they are used as well as the insights and experience of individuals." The best or most appropriate means of transferring knowledge according to this theory is through the use of authentic tasks based on meaningful contexts. Because understanding is based on experience, the relevance of the experience is important to the individual's capacity to apply these ideas. The most important thing is that leaning should always take place in a context and that context must provide a relevant link to the desired knowledge. As a result, in developing instructions, the teacher must focus on

accurately representing tasks as opposed to defining the structure of learning necessary to complete a task.

The constructivist theory is based on a set of assumptions such as an emphasis on the identification of the context in which the skills are to be learned and afterwards applied. The other assumption or necessity for the theory is on learner experience where the learner is considered to be in control and capable of interpreting or manipulating information (Ertmer & Newby, 2013). The theory also assumes that it is possible to present information in a variety of ways; this is important as it presents different scenarios to develop different conceptual perspectives. Furthermore, the theory is based on the ability to support the application of problem resolution skills that enable learners to span their knowledge beyond the examples or the information given. The assessment of knowledge in this case is based on the success of transferring knowledge and skills (Roberts & Potrac, 2014). On actual learning, both cognitivists and constructivists view learning as a collective effort where the learner is actively involved in the learning process. However, constructivists view an elite role of the learner; this is where the learners are considered as more than a processor of information, since they are also involved in collaborating and interpreting information. In this case, based on the theory the role of instruction is to demonstrate to learners how to develop knowledge, to enhance collaboration with other learners and to show the various perspectives that can be applied to solve a specific problem (Brown, 2006). Instructions also help the learner to arrive at solutions they have independently developed and which they are willing to commit to while appreciating the basis of other views which they constructively dismiss.

The greatest concern is the application of this theory in learning ICT or developing the knowledge of young minds to appreciate the importance of ICT in their lives and use it to develop solutions or anticipate how this knowledge can be applied to solve problems. The most common instruction in schools is one where instructions are embedded in technological tool and is introduced to passive learners (Ertmer & Newby, 2013). On the other hand, instruction is universally created and passed on to learners without appreciating or considering the learners and their respective needs. Constructivism considers the role of ICT; which represents the whole collection of hardware and software to be the basis of learning; it is interpreted as learning with technology. Learning with technology or even learning about technology is based on interacting with the different

tools and materials and in the process inspiring creativity, encouraging high-order thinking and enhancing problem resolution. Adequate interaction is a primary and a critical part of an ICT learning environment. The ICT learning process is aligned with the dictates of the constructivist theory in the sense that the theory is based on helping the learners develop their own interpretations based on the interactive lessons.

Cavas, Cavas, Karaoglan and Kisla (2009) explain that the use of ICT in constructive teaching and learning improves the learning process by doing the following; it motivates learners, it makes learners more confident on their own abilities and lastly it creates interest and captures learner interest. Proper instruction is important in creating opportunities for learners to apply in the learning environment through simulated situations. Teaching technology or ICT using the constructivist approach develops the understanding of learners not only of the ICT hardware and software, but also how this can be applied in developing solutions for problems around the learner or from their homes. The focus is not to develop a mechanised form of knowledge transmission the focus is to create connections between the learner situation and the areas of IT that are congruent or capable of resolving the problems that learners are going through or likely to experience. Through this approach, it is possible to get learners to work together to develop solutions, to argue, develop meaning or participate in various pedagogical activities. This encourages learners to become knowledge producers, since modern learners find little meaning in absorbing or learning factual information. The learning activities under the constructivist approach emphasise construction and discovery of knowledge; learning tasks are constructed to nurture independent learning and avail chances to develop understanding. The basis of learning is to ensure that learners attain knowledge in an effective and efficient manner (Tedla, 2012).

2.12.3 Connectivism

The two theories discussed this far have been applied in education and formulating teaching and learning models for decades. However, they are not the only theories that have been applied in developing learning approaches; there is a third one identified as connectivism. Goldie (2016) explains that the modern world has advanced and is currently strongly reliant on technology. The technological advances have grown exponentially and are expected to continue in a similar path, because research into this area continues and individuals as well as corporates are investing in developing technology. One defining invention was the discovery and spread of the internet. The

Web 2.0 increased access and has opened up the world enabling people to communicate freely and unobstructed all across the world. At the same time, the internet has created multiple opportunities; one of the opportunities has emerged in the knowledge field inside and outside the formal educational institutions (Duke, Harper & Johnston, 2013). Traditional methods of gathering and filtering information are unlikely to survive or remain efficient in the view of these developments. In order to develop knowledge, it is also becoming important to harness the views and opinions of others. In order to harness this new knowledge, educators have turned or are likely to turn to learning theories in order to create a model of developing this new knowledge. It is possible that traditional theories may not explain learning in the midst of these new developments and this has created a need to develop new theories that explain learning in these environments. Connectivism is an example of this new theory. The foundation of the theory is not to upset or ignore the principles of the previous theories; however, this new theory is a development and builds onto previous theories. This theory was developed by Siemens (2005). However, it later gained additional contributions from other authors to the point of its current stature.

Connectivism considers learning as a network phenomenon influenced by technology and socialisation (Siemens & Downes, 2008). According to Siemens (ibid.) the theory is based on principles “explored by chaos, network and complexity and self-organization theories”, and it also has strong ties with the constructivist theory. According to the theory, learning starts when learners acquire or assimilate new ideas when participating in learning communities. Learning communities are identified as groups of people who share the same interests. These individuals congregate or come together in groups to share in this commonality, mainly areas of knowledge (Kop & Hill, 2008). Congregation of learners encourages conversation between the members who have different levels of knowledge. In the modern world, individuals or community members do not to come together physically; this is because the internet allows people to share ideas over the media. Additionally, scholars or community members are not restricted to a single way of communication as this can take place in words, images, videos among others. Another importance or advantage provided by Internet is that it also facilitated the creation of personal learning environments; this is critical in improving or enabling production and consumption of learning resources (Goldie, 2016).

The learning community is not the entire group involved in sharing, consumption and creation of knowledge. Instead, this is just a part; a small section of a wider community, according to the theory the learning community is just a node. In a regular network, a node is a section of a network, and a network is a made up of multiple nodes. In describing the theory, nodes are different communities of learners and maybe libraries, websites, databases, journals among other critical reservoirs of knowledge. Nodes vary in size and this is dependent on the level of learners, numbers of learners as well as the concentration of information being shared (Duke, Harper & Johnston, 2013). Not all nodes are efficient or successful with the most successful nodes said to share the following elements; they are diverse, this means they have a varied view. They do not have a shallow approach or view on selected subjects. The other characteristic is that there is a concentration of learners with the same notion or intention; it is autonomous. The learners and the system are open, this means it allows free sharing of information, mainly entering new information onto the systems. Lastly, a good node allows connectivity. Networks do not have a designated size; some have small numbers whereas others have large and vast numbers and have a global stature. In the process of learning, a host of subjects and topics can be studied, since the knowledge areas are porous. This gives learners a wide and diverse source of information and knowledge that has been supplied by members of their network. The best aspects are the fact that these individuals are able to access this information on demand as networks are dynamic and interconnected. This line of thought is linked to utopia as developed by Illich (1971); a utopia envisions a situation where societies are developed as networks of relations. Learners access necessary resources from these networks at all times. The difference with the network envisioned here is the fact that the current network is global and covers a wide area, unlike the former, which only looked at aggregating the local people.

Reverting to connectivism, the theory considers knowledge to be distributive; that is knowledge is not localised; it is randomly distributed through different networks that result from varied experience of different individuals, societies, organisations and technologies that bridge them. Gaining knowledge is a process, a constantly flowing process with networks as the conduits (Kop & Hill, 2008). As knowledge flows through these networks, it is subject to varied interpretation and change. In the end, no single individual owns knowledge, instead it is spread across the network where everyone can access it and contribute to it but never stake a claim on the same. At the same time, it is stored or

hosted in different media, yet there is no single medium hosting or storing this knowledge however, all the forms are digital formats of storage (Kop & Hill, 2008).

It is clear that connectivism is not an established, but a revolving and a novice theory. More so, it is also understood as a theory of the mind where patterns of connection are distributed in neural networks of the brain. These networks arise naturally as individuals interact and associate with each other. Since they are based on constructive interaction they also tend to diminish when an individual remains inactive or dormant. In this regard, knowledge is viewed as interconnected. This establishes the main difference between this theory and cognitive theory, the cognitive theory considers knowledge as sub symbolic where an individual constructs knowledge from an interaction of sets of connections as opposed to single symbolic units (Downes, 2006). The importance of knowledge lies in the ability of an individual to recognise and interpret patterns and connections that arise. Furthermore, knowledge can be considered or interpreted as personal, because individuals can display different interpretations thereof. At the same time, it is context sensitive, where meaning shifts with a change in context; it is only comprehensible based on an individual's experience and past connections.

The most prominent question in this context is on the learning process. Based on this theory, learning occurs or takes place through construction and traversing networks. Learning happens when an individual participates or takes part in a network. Once an individual or a participant in the network perceives the salient patterns in the network then he is deemed to be learning. An individual makes these connections by interaction and through different brain connections. The theory is also involved in the notion that learning can actually take place in "non-human appliances" where it can reside and be manipulated through technology (Kop & Hill, 2008). According to connectivism there is no clear or single means of transferring knowledge; instead knowledge arises during network activity. The theory envisions that the development of the Web and the interconnectedness of individuals through networks mean that the supply and access of information are rampant and rapid. The relevance of information in such a system is constantly affected or influenced by new additions to all knowledge fields. Given this reality, it is paramount for learners to be able to access all emerging information; they should also be able to determine its relevance and make decisions based on the acquired information (Duke, Harper & Johnston, 2013). The capacity to gain access to this new

information and determine necessary and unnecessary information is a crucial skill that contributes to learning. Learning is a cyclical process, where learners must be hinged in a network in order to access and share information; they must alter their beliefs based on new information and reconnect to share new knowledge and access additional information.

In education, connectivism has widely been applied through the use of enormous open learning courses. These meet the idea of networks envisioned by Siemens and Downes (2008). This is because they incorporate a lot of learners who are able to connect to each other and access a wide range of materials. The role of a teacher in this case is to facilitate learning and, in some cases, they are absent in the learning process. Educational material is provided or supplied through RSS feeds and learners were free or are free to join with their preferred tools, such as blog posts or scheduled virtual meetings. Leaners are encouraged to contribute and participate in these networks as this is the way knowledge is created, shared and advanced. This means of education and learning has largely been adopted by tertiary institutions with the most successful model being practised by Stanford University. There has been widespread criticism of this theory as a paradigm to new teaching or learning. However, the researcher reserves this criticism to its application in the target high school and its potential to enhance technology or IT learning in FET.

Regarding the theory's application in improving ICT education in high schools, the theory falls short because of a number of factors that are necessary for the theory to be operational or to deliver. Firstly, Connectivism succeeds or is based on the interconnectedness of individuals with the current platform being the Web. As the situation stands, the penetration of the web in South Africa is restricted to the macro level. Due to poor ICT infrastructure in high schools it is impossible for learners to understand or appreciate the importance of the web in connecting learners (Duke, Harper & Johnston, 2013). More so, the level of education or the idea of high school IT education is to introduce learners to basic IT concepts. Connectivism envisions that the users are already using and navigating through the web, which is not the case with a majority of learners in high schools. In South Africa, the number of learners in high schools who have gained adequate knowledge on IT is not enough to build nodes that can constantly access, share and contribute to development of knowledge. This is because there is a

poor ICT infrastructure in South African high schools and the DoBE is only presently focusing on entrenching IT education in high schools. The biggest population in the country is unaware of the demands or the needs of having necessary or requisite IT education. Connectivism as theory can only work if a dedicated channel or network is developed that congregate this level of learners together and presently there is no capacity or effort towards building such a network. More so, even if such a network was to be in place, all learners would need to be efficient in the requisite ICT skills to actively add to and access information in these networks which again is not presently the case. Lastly, the development of knowledge requires high capacity individuals who are able to contribute to knowledge. As Siemens (2008) explains, the capacity to determine necessary and unnecessary information is a crucial skill that contributes to learning. There are questions on whether high school learners have reached this level of maturity and whether they can actually be able to successfully filter information. Therefore, there is real question on whether learning can happen in a dedicated network for high school students, given their developmental stage. Ultimately, connectivism can contribute to knowledge and learning, but it requires a developed mind and infrastructure which is absent at high school level.

2.13. CONCLUSION

This section has evaluated literature in four areas that are considered important for the completion of this research. The areas include literature on teaching approaches; to this end this section has revealed that the approach a teacher uses has an impact on learner success. Of the three methods of teaching namely teacher-centered, learner- centered methods and a hybrid method which incorporates both the designs of teacher centered and learner-centered approaches the hybrid method is the most effective. It harnesses learner contribution and participation by encouraging conversation and at the same time scaffolds onto the teachers' experience and knowledge in the subject area. Additionally, this section has also delved into the role and importance of IT in the modern world. It is quite evident that the DoBE has perceived the immediate need to introduce IT education in South African schools. This decision is informed by the desire to have learners who are well prepared for the increasingly technology-oriented world and also develop competitive learners. The education policy is also keen on improving the learning process by introducing IT which eases and modernises the learning environment. From the

ensuing literature, it was evident that IT is not a luxury, but a need in the current world. Nonetheless, there are many challenges in fully implementing IT education or an ICT infrastructure in South African high schools. The most prominent challenges embrace poor infrastructure where most schools are yet to be connected to power, lack of elaborate training for teachers which are informed by a lack of basic IT training in teaching colleges, and this problem is currently being remedied but the biggest population of teachers who lack these skills. There is also a lack of adequate technical people to help maintain ICT equipment in schools, where ICT infrastructure has been set up. Lastly, IT education has only been enumerated in policy, but there is minimal focus in developing IT educational material meaning the education system is disjointed across different regions, zones and schools. The last section of literature review focused on developing a proper IT learning theory. Based on the challenges and the disjointed nature of IT education in South African schools, this literature has established the need to develop a theory that guides development of a practical, efficient and effective teaching and learning approach. This approach is capable of developing learners who are able to harness their experiences and the information supplied by IT to develop solutions and advance their knowledge. To this end, two theories have been exhaustively examined; the behaviorist theory and the constructivist theory were incorporated. Based on scholarly reviews the constructivist theory or approach has been identified as the most applicable in developing a fitting IT learning and teaching approach for learners in high schools.

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

This research seeks to put in place possible measures to improve the effectiveness of teaching and learning of Information Technology among the Grade 12 learners of the target high school. This section focuses on how the study was conducted. This chapter is pertinently arranged according to the following headings: the research methods, population and sample selection, the research instruments, data collection procedure and data analyses procedure.

This research endeavours to put in place possible measures to improve the usefulness of teaching and learning of Information Technology among the Grade 12 FET learners in Kwazulu Natal. In addition, it will consider the value of IT. It will look at the various methods to employ in the teaching and learning of IT. This chapter describes and discusses the following; research design, research population and sample techniques, data collection instruments, data collection procedures and data analysis.

3.2 RESEARCH METHOD AND DESIGN

Mixed-methods research is the type of research in which a researcher or team of researchers combines elements of qualitative and quantitative research approaches (e.g., use of qualitative and quantitative viewpoints, data collection, analysis, inference techniques) for the broad purposes of breadth and depth of understanding and corroboration (Johnson, Onwuegbuzie & Turner, 2007:123).

Mixed methods bring together qualitative and quantitative research approaches to provide a more comprehensive and detailed understanding of the phenomenon under study and /or explain certain anomalies in the data.

Tashakkori and Teddie (1998) refer to mixed methods studies as those that combine the qualitative and quantitative approaches into a single research methodology. Johnson and Onwuegbuzie (2004) indicate that mixed-method research is the class of research where the researcher mixes or combines quantitative and qualitative research techniques, methods, approaches, concepts or language into a single study.

Application of mixed-methods research: Two main factors that help researchers to design and conduct a mixed methods study are implementation of data collection and priority (Morse 1991; Morgan 1998; Tashakkori and Teddlie 1998; Creswell 2003). Implementation of data collection refers to the sequence that the researcher uses to collect both quantitative and qualitative data.

A research design is a plan or strategy which moves from the underlying philosophical assumptions to specifying in selection of participants, the data gathering techniques to be used and the data analysis to be done (Maree, 2007:70; Terre Blanche & Durrheim 2002:29). This means that a researcher, uses a research design to investigate, explore and to obtain answers to research questions such as: What methods of teaching can be employed in teaching and learning of Information Technology at FET level?

A research design is the logic that links the data to be collected (and the conclusions to be drawn) to the initial questions of a study. Every empirical study has an implicit, if not explicit, research design (Yin, 2017). A research design also defines the domain of generalisability, that is, whether obtained interpretations can be generalised to a larger population or to different situations (Nachmias & Nachmias, 1992:77).

Another way of thinking about a research design is as a “blueprint” of research, dealing with at least four problems: what questions to study, what data are relevant, what data to collect, and how to analyse the results (Borum, 1991; Philliber, Schwab & Samsloss, 1980).

Upon going through the types of mixed-methods approaches, the researcher opted for a sequential explanatory design. The mixed-methods sequential explanatory design is highly popular among researchers and implies collecting and analysing first the quantitative and then the qualitative data in two consecutive phases within one study. Its characteristics are well described in the literature (Tashakkori & Teddlie 1998; Creswell 2003, 2005; Creswell, Plano Clark, Gutmann & Hanson, 2003), and the design has found application in both social and behavioral sciences research (Kinnick & Kempner, 1988; Ceci, 1991; Klassen & Burnaby, 1993; Janz, N.K., Zimmerman, M.A, Wren,P.A., et al 1996).

A sequential design is one that is executed in a deliberate, staged approach where the design is progressive; this is where one step is completed and the subsequent part follows shortly after (Creswell, 2014). The assumption or the basis of this approach is

that each stage contributes or adds to the previous stage until there is enough data to test the stated hypothesis. In a sequential design the sample size is not priory defined. After every sample is analysed, the research can admit the null hypothesis, proof the alternative hypothesis or select a new pool to proceed with the research. Using a qualitative approach, a sequential study applies sampling techniques to gather data and apply the appropriate statistical approaches to manipulate data. Applying a quantitative approach, sequential studies will apply samples of individuals or cohorts and apply the appropriate qualitative approaches such as interviews to gather necessary data (Salkind, 2010). A sequential approach gives the researcher infinite sample size options. The other factor is that this approach requires the researcher to play a minimal role in research meaning it is very affordable and requires very little time to conduct. On the other hand, exploratory research is explained as preliminary research into a research problem (Creswell, 2014).

The present research focuses on the best means of teaching and learning ICT which is an area that has recently gained scholarly attention. However, relevant research has focused on the importance of ICT in the learning process and little has been done in determining the best approach to teaching ICT in high schools. The researcher is aware of the current practice where teaching IT in schools is done in the same way the teachers approach other subjects. A sequential approach is applied to progressively develop the information given by the interviewees applying each of their observations to improve and develop a progressive teaching and learning approach.

Despite its popularity and straightforwardness, this mixed-method design is not easy to implement. Researchers who choose to conduct a mixed-methods sequential explanatory study have to consider certain methodological issues. Such issues include the priority or weight given to the quantitative and qualitative data collection and analysis in the study, the sequence of the data collection and analysis, and the stage/stages in the research process at which the quantitative and qualitative phases are connected and the result are integrated (Morgan, 1998; Creswell et al., 2003). Although these issues have been discussed in the methodology, literature and the procedural steps for conducting a mixed-method sequential explanatory study have been outlined (Creswell, 2003;2005), some methodological aspects of this design procedure still require

clarification. For example, it is imperative to decide which method to assign priority to in this design, how to consider implementation issues, when to connect the quantitative and qualitative phases during the research process, and how to integrate the results of both phases of the study to answer the research questions.

Providing some practical guidelines in solving those issues might help researchers make the right and prompt decisions when designing and implementing mixed-methods sequential explanatory studies. It might also provide additional insight into the mixed methods procedures and results in more rigorous and reliable designs. It is also important to help researchers visually represent the mixed-methods procedures for their studies. Such graphical modeling of design might lead to better understanding of the characteristics of the design, including the sequence of the data collection, priority of the method, and the connecting and mixing points of the two forms of data within a study.

A sequential research design was used in this study, because of the following reasons:

- It is straightforward;
- It gives opportunities for exploration of the quantitative results in more detail;
- This design is useful when unexpected results arise from a quantitative study (Morse 1991); and
- Quantitative data which is going to be questionnaires that begins the phase, arise the interest of the respondents in the research process.

3.3 THE ROLE OF THE RESEARCHER

The researcher in this study had a series of responsibilities. The most prominent role was in data collection and subsequent data analysis. The research data were to be gathered using three main approaches; through questionnaires, interviews and observation. These three methods required the presence of the researcher. Questionnaires were written questions by the researcher that were asked to address the aims of the research. The researcher may choose not be present when participants are responding to the questions, but it is advisable for a researcher to be present, in order to guide or monitor participants during giving feedback. The researcher administered questions that were short and clear. In the interviews, the researcher, understanding the essence of this inquiry needed to ensure that questions were adequately answered. He also captured the information and data given by the interviewees. Furthermore, he also used observation as a data gathering approach. Observation demands the researcher to be

physically present in the classroom and take note of the necessary cues. In doing this, the researcher has the responsibility to ensure that the interviews and the observations made are not influenced by biases or force or lead interviewees into giving relevant responses. The researcher needs to avoid and safeguard against this happening. In this study these aspects were carefully considered.

Lastly, the researcher was under an obligation to establish a rapport with the participants. This is essential in winning the confidence of the participants and creating an environment of honesty and trust. This is important in ensuring the participants give honest and thorough answers as they understand they are part of a study that would change the way IT information is passed on to learners and to determine how this knowledge can be applied to enhance learning processes. Cordial relationships with the participants allowed the researcher to be exhaustive and thorough in his interviews and the participants were willing to provide exhaustive information that enriched the information and data gathered for this research.

3.4 RESEARCH POPULATION

According to Burns and Grove (1993:779), a population is defined as all elements (individuals, objects and events) that meet the sample criteria for inclusion in a study. Polit and Hungler (1999:37) refer to population as an aggregate or totality of all objects, subjects or members that confirm to a set of specifications. Babbie and Mouton (2001) define a population as the aggregate of elements which the sample is selected from.

Bless and Higson-Smith (in De Vos 2002) refer to population as the set of elements that the researcher focuses on and to which the obtained results should be generalised. Additionally, Polit and Beck (2006:506) describe the population as an entire set of individuals having some similar characteristics.

A research population is generally a large collection of individuals or objects that is the main focus of a scientific query. It is for the benefit of the population that research is done. However, due to the large sizes of populations, researchers often cannot test every individual in the population, because it is too expensive and time-consuming. This is the reason why researchers rely on sampling techniques.

A research population is also known as a well-defined collection of individuals or objects known to have similar characteristics. All individuals or objects within a certain population

usually have a common, binding characteristic or trait. The research was concentrated on two categories of study groups who were selected as the target population. The population consisted of teachers and all Grade 12 learners teaching and learning IT in the target FET school respectively.

Babbie (2010) defines research population as the group the researcher is focused on generalising about. The population is the total number of elements from which the participants are chosen and all elements that share characteristics can be chosen for the sample. In this research this section of the population is referred to as the research population and represents the set of elements that the researcher based his study. The target population was selected by the researcher, because they were likely to have the desired information and had been involved in IT classes which were the focus of this research. A qualitative approach was also used in settling for the target population; using this approach involves applying a subjective approach towards choosing an information rich population that provides the appropriate information on the case under study. A qualitative approach to sampling increases the usability of information that is generated from the participants. A properly or objectively chosen target population is able to provide a rich and detailed insight into the subject being studied.

3.5 SAMPLING TECHNIQUES

Maree (2007:79) refers to sampling as the process used to select a portion of the population for the study. The convenient sampling technique was used to select the respondents. The respondents were consecutively selected in order of appearance according to their convenient accessibility. The sampling process comes to end when the total number of respondents and the time limit are reached. Three (3) teachers and twenty-seven (27) learners making a sample total of thirty (30) respondents were chosen for the quantitative part of the study. The research could not involve every member of the population, because it would be extremely expensive, impractical, time-consuming or probably would require the service of other research assistants. The thirty respondents were more convenient to handle.

The basis was to have a sample of teachers and learners who have participated in the IT classes for a while that it is focused on Grade 12. Since the focus was on a single high school the intention was not to focus on all schools, but rather on a single school with

learners and teachers who have had adequate exposure to IT and the methods used in teaching and learning the subject.

The sample in this case involved 30 participants. Of the 30 participants, 27 were learners whereas 3 were teachers. 4 participants were interviewed (3 learners and 1 teacher). The sample size was deemed adequate given the overall population of the school and also the level of exposure with this sample representing learners who have constantly received IT education and teachers who were involved in teaching the learners. The study took place at an FET group in a high school within the large KwaZulu-Natal. The school introduced IT in their curriculum in line with the present effort by the DoBE to have all schools assimilate progressive studies to produce refined and well-prepared learners to face the challenges of the modern corporate world. The schools offer IT under Line 2 subjects, the same line identifies other IT related subjects such as Computer Application Technology and Engineering Graphics Design. More so, the school has a well-established IT infrastructure having introduced IT much earlier than most schools in the country.

3.6 DATA COLLECTION INSTRUMENTS

The basis of an in-depth study or inquiry is data generated from the target population or the selected participants. In order to gather the right data, a researcher must make use of appropriate data collection methods. The right data collection methods involve the use of the right strategy; these include approaches such as interviews, observation and the use of questionnaires. These strategies are harnessed to gather relevant data to answer or develop an appropriate solution to the stated research problem. This research used a mixture of data collection strategies; the three are questionnaires, interviews and observation to gather appropriate data to answer the research questions (Shelly & Rosenblatt, 2009).

3.6.1 Questionnaire

Microsoft Encarta Dictionaries (2009) suggests that a questionnaire is a set of questions used to gather information in a survey. A questionnaire is also written instrument that is made up of series of questions that attempt to collect information on a particular topic. Cohen and Manion (1995) claim that, reliability and validity of data collected from a questionnaire can be assured, because it allows for broad geographic sampling views. The questionnaire is especially useful to obtain information about reasonably big groups. It is usually characterised by relatively low cost, ease of interpreting information, and likelihood of answering each question (Gerber & Wheeler, 2009).

According to Lavrakas (2000) questionnaires are data collection instruments that involve the use of questions to invoke a response from the research participant. Questionnaires are preferred, because they are relatively cheap to administer. At the same time, they are used to gather large amounts of data from a large sample. It is efficient and fast because the researcher does not have to be present to conduct the research. Since there are 30 participants, it is impossible to carry out interviews and even if this was to be the case it would consume a lot of time. Therefore, questionnaires were preferred as a means of gathering data from the entire target population and within the shortest time possible. Questionnaires are also preferred as they are able to conceal the identity of respondents and hence, they are an effective means of gathering attitudes, preferences and opinions exhaustively.

A self-compiled questionnaire was prepared and administered by the researcher for respondents, who were the teachers and the learners. The items in the questionnaire were based on variables such as methods of enhancing the teaching and learning of IT. A total of thirty (30) questionnaires were developed, printed and distributed to the respondents. The researcher explained the key term to all respondents. The items in the questions are closed-ended. With the closed-ended question, the respondents were given a number of options to make a choice.

Time was allotted to respondents for the completion of questionnaire. The respondents completed and submitted the questionnaires at the given time. Each questionnaire was

accompanied by a letter which explained the purpose of the study and clearly stated that all information that they gave were confidential. Each respondent was individually informed about the purpose of the study and anonymity was emphasised to each respondent. Each respondent was given ample time to complete the questionnaire in the presence of the researcher. This gave the chance for the respondent to ask for any clarification of the questions when necessary. Furthermore, this ensured that all questions were answered as the researcher personally monitored the completion of each questionnaire. Some learners and a teacher that showed more interest and willing to give more information were selected to participate in the interviews.

3.6.2 Interview

According to Marshall (1997), interview is a face-to-face meeting between an interviewer and interviewee in an attempt to collect data for studies. It provides the opportunity for personal contact and yields a higher response rate. Interviews also provide an opportunity to the interviewer to probe for specific meanings of response made by interviewee. However, it has some limitations, which if not addressed will affect the accuracy of data collected, but Marshall and Rossman (1999) affirm that with proper construction of an interview schedule and correct procedures adopted, an interview can be an effective data collection technique for any research. Based on this, interview guides were prepared and these guides were adhered to during the interview sections which ensured the effectiveness of it as a tool in this study.

Interviews were applied on 1 teacher and 3 learners. Structured type of interview was adopted. Interviews were face-to-face on a particular day. All four participants were interviewed on the same day. The interview occurred a month after the questionnaire was administered. This was done a week after the first interview was conducted.

As a data collection approach, interviews are used to gather data on a face-to-face basis and allow the researcher to create a rapport with the interviewee. There is a rationale behind the choice of interviews as a data collection approach. One of the main reasons behind the choice of interviews is the fact that they provide participants the necessary freedom to answer and explain their thinking or responses. At the same time, the interviews gave the researcher a chance to clarify any information that was unclear. Interviews provide a chance to further probe a problem that would be left pending through

other data collection methods. The interviewees, both teachers and learners were asked the same set of questions but the probing questions or follow-up questions varied based on the forthcoming nature of the interviewees and the depth of the answers and solutions advanced by the respondents (Shelly & Rosenblatt, 2009).

The interviews were designed to take an average of 45 minutes and were set to take place after class hours. The choice of this time was informed by a need to have the learners and the teachers relaxed and under no pressure to rush the interview or grow impatient. The researcher did not want to interrupt the regular school schedule. Interviews with learners took a shorter time, lasting an average 30 minutes compared to the teachers' interviews which took an average 45 minutes. The interviewees were not under any obligation to answer questions. In order not to miss out on any information a recorder was employed.

After the questionnaire had been administered, the researcher went on further to seek about learners' and teachers' attitudes towards the teaching and learning of IT. This was done verbally (one-on-one). The topic under study was also taken into consideration when four interviewees that consisted of 3 learners and 1 teacher were interviewed by the researcher. The four respondents were selected by looking into some criteria for selecting interviewees such as: Who has the relevant information? Who is accessible? Who is willing to give relevant information? Who is most able to give information?

This method was adopted because it is more direct and has greater flexibility. It is also unique, because the collection of data is through direct verbal interaction between individuals. It also allowed for the exchange of ideas as a means of validating some responses given through the questionnaires.

3.6.3 Observation

According to Marshall and Rossman (1999:107), observation is a systematic noting and recording of events, behaviours and objects in a social setting chosen for the study. Marshall and Rossman (1999:107) add that observation is a fundamental and highly important method in all qualitative inquiry.

Mouton and Marais (1991:156-157) define observation as the process by means of which researchers establish a link between reality and their theoretical assumptions.

Non-participant observation was used in gathering data for this study. Non-participant observation is a relatively unobtrusive qualitative research strategy for gathering primary data about some aspect of social world without interacting directly with its participants (Williams, 2008).

Observation is a method of gathering primary data by which the researcher sees, smells and listens to events as they unfold in a given social setting. The researcher presents himself or herself at the spot light so as to watch proceedings as they happen.

Observation is a technique in which the researcher observes the activities of all the participants (Beiske, 2007). The observer does not play any active role in the activities of the participants. In this study, the observation exercise happened at two different times. The first time was before interviews were conducted and the second was after the interviews were carried out. The idea was to observe the availability of equipment, interaction of the teachers and the learners, form of instructions and lastly the role of both the leaners and the teacher in the learning process.

Observation continuum observation was used. This is purely qualitative observation; it is sometimes called naturalistic observation because observation is done in real-world or naturalistic settings. Qualitative observation is exploratory and open-ended.

Three (3) teachers and twenty-seven (27) learners were observed. They were observed in the classroom situations where teaching and learning of IT takes place. Both teachers and learners were observed throughout the observation period as the researcher becomes a full member of the group without informing them about the process.

The teaching and learning process of IT was observed. The methods used in delivery of daily lessons were observed thoroughly for a minimum of ten (10) times at the school.

The basis of observation was to confirm and supplement the information and data gathered through the interviews. Observation as a data collection method gives the researcher an unbiased insight into the class activities and the methods used by the teachers to teach IT in the class set up. It also gave the researcher a chance to observe

the learning process and therewith determine the efficiency and effectiveness of the learning and teaching methods. Observation lasted through the IT class sessions.

Observation was made to find learners' behaviour towards the learning of IT. The 3 teachers were also observed on teaching and learning methods used in delivering and how well they used those media/material in delivering instructions. Learners' attendance of IT classes, their responses to questions, their class exercises, test items, and their attitude in the computer lab were critically observed.

3.7 DATA COLLECTION PROCEDURES

Data collection was mainly done by three data collection techniques, which are; interviews, questionnaires and observation. Questionnaires were handed to 30 respondents first and then followed by interviewing 4 participants (1 teacher and 3 learners) and observation of 30 participants (3 teachers and 27 learners).

Each questionnaire was accompanied by a letter, which explained the purpose of the study and clearly stated that all information that they gave was confidential. Each respondent was individually informed about the purpose of the study and anonymity was be emphasised to each respondent. Each respondent was given ample time to complete the questionnaire in the presence of the researcher. This provided the respondent the opportunity to ask for clarification of the questions when necessary. Furthermore, this ensured that all questions were answered as the researcher personally monitored the completion of each questionnaire.

Data were collected accordingly after seeking permission from the institution (DoBE). All 30 respondents were contacted directly. Interviews could be conducted in person or over the phone. It was done formally (structured), semi-structured or informally. For this study, interviews were conducted formally (structured). Questions were asked verbally and these questions were focused, clear, and encouraged open-ended responses.

Questionnaires were given to the 3 teachers and 27 learners. Responses were analysed with quantitative methods by assigning numerical values. Results were generally easier to analyse than qualitative data. Both techniques were used in the question.

Observations were thoroughly done by regular visits to the institution. It allowed for the study of dynamics of a situation, frequency counts of target behaviors, or other behaviours as indicated by needs of the evaluation. It was a good source for providing additional information about the group; videos were used to provide documentation. Observation can produce qualitative (e.g. narrative data) and quantitative data (e.g., frequency counts, mean length of interactions and instructional time). Tape recordings, voice recordings, video recordings and note taking were the main ways to document the contents of the interaction with all the respondents.

3.8 DATA ANALYSIS

Burns and Grove (1997:521) define data analysis as a method to reduce, organise and give meaning to data gathered or construction that emerged and these are constructed in a meaningful whole. Data gathered for this study through various strategies; questionnaires, observation and interviews had to be analysed and closely examined so as to develop a thorough understanding of the information (Miles, Huberman & Saldana, 2013). The intention with the data analysis was to refine data gathered through various strategies, in order to apply it in answering the research questions. Miles, Huberman and Saldana (2013) define data analysis as the process of refining data and interpreting results. It is a non-numerical examination and interpretation of observation in order to display patterns and relationships between the data.

This researcher applied two data analysis methods viz.: qualitative and quantitative approaches. Creswell (2014) indicates that qualitative data analysis is a continuous process which links three processes; data collection, processing and data analysis. At this point, data is represented in masses and this needs to be broken down and categorised in a manner that depicts certain patterns and meaning can be attached in reference to research subjects.

The responsibility of drawing these patterns falls on the researcher. The three strategies adopted for data collection gathered data in different forms. Interviews, which were recorded, need to be coded in order to determine the contribution of the respondents to the specific research questions. Data coding entails reducing the data into understandable pieces and relevant topics. The best way to code data is listening to the

recorded interviews intently and labelling different topics. Data is organised based on emerging themes. Organising data in different categories enables the researcher to establish categories and determine the relationship of each of the categories. Data gathered through the other two strategies; observation and through questionnaires is categorised or pooled into the emergent categories and those allowed the researcher to develop concrete evidence on the effectiveness of different teaching and learning practices. The different strategies were likely to come up with a specific number of learning approaches. These were defined or developed on basis of coded interviews. Subsequent information and data gathered through the other strategies were used to add to the depth or ascertain the different categories established through the coded interviews. The most efficient teaching and learning interventions were those with the greatest number of supporters from both the teachers and the learners.

Interviews as a qualitative method can be analysed in three ways. These are thematic content analysis e.g. getting familiar with data, coding the whole text, defining and naming themes, narrative analysis e.g. gathering the stories, comparing and contrasting different stories and looking for interpretations. In addition, qualitative studies can follow a deductive approach which means that the researcher then uses this framework to analyse the data. This tests the pre-existing theories. Themes and concepts are decided before commencing with the analysis and are imposed on material. A narrative method of data analysis was also adopted, analysing participants' responses (Reissman, 1993).

Observations were done thoroughly by regular visits to the school. It allowed for dynamics of a situation, frequency counts of target behaviours, or other behaviours as indicated by the needs of evaluation. Numerous lessons of IT were observed to investigate the methods of teaching and learning.

The researcher took extensive field notes, and when feasible, used audio and/or visual recording devices to establish a record of what occurred for later analysis. Digital audio and video recordings were used as well as available software to sort, index and retrieve observation of lessons for analysis.

Strategies for analysing observations were adhered to in this study. Strategies followed embraced focusing on key issues. They are:

- **Chronology**: describing what was observed chronologically overtime;

- **Key events**: describing critical incidents or major events;
- **Various settings**: describing various places, sites, settings or locations in which events or behaviors of interest happen;
- **People:** describing individuals or groups involved in the events; and
- **Processes**: describing important processes e.g. control, decision-making, and communication.

A checklist that contains a list of different features of a lesson was used for analysis. Checklists provide a clear focus for observation and help in analysing.

A questionnaire was analysed by graphical methods of analysis representing plots. The responses can be graphically represented and combined into categories such as “agreed”, “partially agreed”, and “disagree”. Moreover, numerical indicators such as average score (mean) can be used to analyse. Interpreting the information provided by the respondents and relating it to the main objectives of the study are essential steps in data analysis. Since information collected from respondents are through tape recordings, voice recordings, video recordings and note-taking, they need to be analysed (Harling, 2012).

The researcher examines raw data using interpretations in order to find linkages between the research object and the outcomes with reference to the original research questions. Throughout the evaluation and analysis process, the researcher remains open to new opportunities and insights. The case study method allows an investigator to retain holistic and meaningful characteristics of real-life events (Kohlbacher, 2006). This further implies that holistic inquiry involves collection of in-depth and detailed data that are rich in content and involve multiple sources of information; including direct observation, participant observations, interviews, audio-visual material, documents, reports and physical artifacts (Harling, 2012).

The tactics used in analysis force researchers to move beyond initial impressions to improve the likelihood, accuracy and reliability of the findings. Exemplary case studies will deliberately sort the data in many different ways to expose or create new insights and will deliberately look for conflicting data to disconfirm the analysis. The researcher categorised, tabulated, and recombined data to address the initial propositions or purpose of study, and conducted cross-checks of facts and discrepancies in accounts.

He focused on short interviews where necessary to gather additional data to verify key observations or to check facts.

Specific techniques include placing information into arrays, creating flow charts or other displays, and tabulating frequency of events were used. The researcher used the quantitative data that has been collected to corroborate and support the qualitative data which is most useful for understanding the rationale or theory underlying relationships. Finally, after the presentation, analysis and interpretation of the findings, conclusions were drawn, recommendations made and suggestions given for future research.

3.9 VALIDITY AND RELIABILITY

Shelly and Rosenblatt (2009) define reliability as the consistency of measure. A reliable result is one that provides the same results in succession. Reliability is used as a tool to gauge the consistency of information or data results and should consistently provide the same results. To proof reliability, test-retest reliability is used; this is a test that is applied at least twice over a period on the samples. The results in these two tests should be consistent for the reliability test to be passed. The methods applied for these results and the ensuing data is passed as reliable, because it can provide the same results if repeated. Validity is again defined as the extent to which the scores represent the variable they are intended to measure (Shelly & Rosenblatt, 2009). In this case, the chosen sample involves or represents the population of IT learners in South African high schools. The selected sample share characteristics with the rest of the students who are presently being introduced to IT studies in the country.

This is important in generating results that can be applied in all schools and deliver the desired results. Valid data is important in ensuring that the results from this research can be applied to improve the status of IT education in the country by improving the teaching and learning approaches.

3.10 ETHICAL CONSIDERATIONS

Ethical considerations are concerned with the appropriate conduct of research. It is concerned with what is wrong and right. Hence, ethical considerations are standards and the basis of research conducted throughout. The goal is to ensure that the researcher upholds the desired code of ethics (Creswell, 2014). This also speaks to morals with the

need to treat data and respondents in a cordial and ethical manner. A number of ethical issues are relevant for this research. These include the need to acquire all the necessary authorisation; this involves an authority from the University to carry out this research and due consent from the target high school to conduct this research in their school. Additionally, the researcher also reached out to the target population in order to ensure that they were willing and offered their consent to be included as respondents and participants in this research. The other issue is retaining the confidentiality and anonymity of respondents. Furthermore, there is adequate focus on developing a friendly approach so as not to upset or harm respondents in the course of research. Anonymity was ensured and the focus was on voluntary participation.

Ethical considerations can be specified as one of the most important parts of the research. Dissertations may even be doomed to failure if this part is missing. According to Bryman and Bell (2007), the following ten points represent the most important principles related to ethical considerations:

- Research participants should not be subjected to harm in any way whatsoever;
- Respect for dignity of research participants should be prioritised;
- Full consent should be obtained from the participants prior to the study;
- The protection of privacy of research participants has to be ensured;
- The adequate level of confidentiality of the research data should be ensured;
- Anonymity of individuals and organisations participating in the research has to be ensured;
- Any deception or exaggeration about the aims and objectives of research must be avoided;
- Affiliations are any forms, sources of funding, as well as any possible conflicts of interests have to be declared;
- Any type of communication in relation to the research should be done with honesty and transparency; and
- Any type of misleading information, as well as representation of primary data findings in biased way must be avoided.

3.11 Conclusion

This chapter covered the research design, methodology and research type. It was pointed out that mixed methods were used to arrive at triangulation to corroborate the findings. Furthermore, the sampling methods and respondent and participant details were provided. The next chapter deals with the findings of the study.

CHAPTER 4

RESULTS, DISCUSSIONS AND INTERPRETATION OF FINDINGS

4.1 INTRODUCTION

The importance of this chapter is harnessing the data and drawing the patterns of the data gathered and analysed through the methods discussed in Chapter 3 to answer or contribute to the resolution of the research questions. The first part of this chapter focuses on data analysis and empirical findings. The subsequent section will focus on the contribution of the analysed data in developing methods that promote teaching and learning of IT in high schools which is the primary intention of this research. This chapter relies on the information gathered in Chapter 2 to support and explain the results of the ensuing analysis. The analysis and link of information in Chapter 2 and the findings from the research are largely connected by inductive and deductive analysis.

4.2 PRESENTATION

Presentation is based on drawing sensible conclusions from data gathered through observation, interviews and questionnaires. Bowen (2009) describes it as the procedure through which a researcher manipulates qualitative and quantitative data into organised and systematic presentation in order to interpret and understand the phenomenon being studied. It is an engaging process, which starts in the field as the researcher gathers data and interacts with the target population. It later involves the researcher compiling and sorting out data to form coherent patterns. As described in Chapter 3, there is a definite process followed while sorting out data, the first of which is data coding, the second stage is channeled analysis where coding is done on the basis of the research question and theory which makes it possible for themes to emerge from the data. The last stage is content analysis, which entails drawing meanings from the constructed themes (Shannon, 2005).

4.3 THE TEACHERS' PROFILE

There were two methods employed in gathering data from teachers. The first method was interviews which were conducted with one teacher and three learners. The other three teachers responded to the open-ended questions on the questionnaire. Of the three

teachers, one teacher was female and the other two were males. Since all the teachers taught from the same school, they shared the same facilities and were largely expected to have the same experiences. The target high school has a computer laboratory and a well-developed ICT infrastructure. ICT is largely adopted in the teaching of most subjects. Nonetheless, the biggest exposure to IT or ICT is left to teachers who are currently teaching IT and other related subjects. A few more teachers who are able to link different aspects of their subjects with ICT are also free to apply ICT in teaching and facilitating learning. This said, it is important to note that the level at which the target high school has adopted ICT is rare in South African schools and therefore, represents an advanced model on how ICT can be leveraged to ensure the best results. This aspect makes it the best population to study or examine the best teaching and learning methods.

This is because the teachers and the learners have been exposed to different approaches. In this case, they are able to critique and offer an objective opinion on various approaches and test different learning theories with the desire of having a concrete approach which maximises student participation and the teachers' knowledge.

The teachers taking part in this research were identified as teacher #1, #2 and teacher #3. The interview session involved teacher #2. Teacher #1 was a male teacher who has taught Grade 10 to 12 in the school for six years now. Overall, his teaching experience spans beyond eight years. In regard to ICT, his full exposure to ICT in the learning process happened in the target high school for the six years he has been in school.

According to the teacher, even though he loved technology he was not able to learn various IT aspects in his basic training as a teacher. However, he was able to complete three courses on ICT and this has improved his knowledge of ICT and is also able to integrate the school ICT infrastructure into his teaching methods. He owns a personal laptop and a smartphone which allows him to keep up with any technological demands in class and beyond. He considers himself technologically informed. He is not involved in teaching IT, instead he teaches Mathematics and Life sciences in the school. Due to his knowledge over the past six years and interest, he has been able to prepare notes and also gather reading materials online which he uploads onto the school information portal. These are tutorials and tests to encourage learners to continually apply and interact with the school's ICT infrastructure. He considers this as an important part of the learners'

development. Besides, it is an inevitable undertaking given that all communication in the modern workplace is technologically mediated.

Teacher #2 is a male teacher with an overall teaching experience of 7 years all in Newcastle High school. The teacher studied IT in his undergraduate and is currently pursuing a postgraduate degree in the same field. The teacher is directly involved in teaching IT in Grade 10-12. He also handles additional technological courses such as graphic design and sits in the IT department which constantly evaluates the current ICT infrastructure. As a senior member of the department, the teacher is involved in studying and researching ICT deployment in schools and its use in the learning process. The interest is to ensure that the target high school has the best ICT infrastructure and that this remains up to date. Moreover, he is involved in in-house training. This is a situation where he trains teachers on various ways, they can harness technology to ease teaching and how to improve their individual IT skills. The background and practice ensure that teacher #2 is continually involved with learners and in development of class material. His interest is ensuring that the information he has is clearly communicated to the learners in an exciting and understandable manner. The teacher notes that much has changed since he joined the school. He has changed the previous approaches in teaching IT. The previous teachers or the previous approach focused on the teachers' knowledge and failed to invite learners to contribute to the learning experience. In addition, there was a large emphasis on examinations and tests, which stressed learners. As a result, learners largely used past exams to revise for tests and this led to increased performance over the years. However, this affected the learners' interest in the practical aspect of IT. The learners learned towards passing examinations at the expense of learning or acquiring practical knowledge. The teacher has revised this and is encouraging learners to learn how to solve problems using IT and also use their experience to reflect on the application and use of IT in their day-to-day activities.

Teacher #3 was a female teacher. She has been teaching at the target high school for three years. She teaches languages and has a clear passion for technology. Having left college about five years ago, she had the benefit of studying and being trained in an ICT environment. This eased her experience and developed her understanding, from an earlier stage, of how IT can be used to improve learning and teaching in class. She prepares her notes using different software, mainly PowerPoints. She is involved in

developing the school information portal, which is currently used to upload and store tests and notes for learners to access on demand. She was generally pleased with the learners' reception of technology. Being among the youngest staff members she carries relevant knowledge on the demands of the job market and life in general and the reliance of these on technology. She is keen to develop efficient and effective teaching methods to ensure that students assimilate subject content and also appreciate the application of technology in all facets of life.

4.4 THE LEARNERS' PROFILE

The learners involved in this study were all in Grade 12. The research focused on learners who have had time to interact with the school's ICT infrastructure as well as improve their understanding of the teaching and learning approaches employed by various teachers. It would have been appropriate to include learners from other Grades, but the need to include observation as a data gathering technique made it impossible. The researcher desired to participate in a single lesson where all the respondents were participating. This meant choosing the same Grade and learners who attend class at the same time. Each class in the school has about 40 learners; however, these learners are divided into groups when visiting the computer laboratory for practical reasons. Therefore, the chosen number of 27 learners was a single group of the overall learners in Grade 12. All the learners had been studying IT since Grade 10 and were well versed in the subject. They have been taught by three different teachers and are able to differentiate the teachers' approach and settle on those with the best teaching approach.

For lack of a better description, this is the most experienced group of IT learners in the target high school. Three learners, identified as Learner A, B & C were involved in interviews. All learners were able to fully utilise the school's ICT infrastructure to carry out different functions such as develop in-class presentation, send emails, upload and download class material from the school portal and also carry out individual research through different search engines. Learner C is currently also pursuing Computer Application Technology.

4.5 NON-PARTICIPANT OBSERVATION

In reference to the data collection methods cited in the previous chapter, the third means of data collection beyond interviews and questionnaires was non-participant observation.

This explains a means of data collection where the researcher took part as an observer in two class sessions conducted by teacher#2. Teacher #2 was the IT teacher for the Grade 12 learners. As mentioned, the entire class was divided into three groups in order to capitalise on the teacher's knowledge and abilities. Containing the entire class in a single practical session would not help every learner as there was a concern that some would lag behind. Besides, the class session lasted 45 minutes and a maximum of 90 minutes would not be enough as the teacher attended to the needs of each of the learners. The large number of learners made it difficult to assist learners individually. Furthermore, the teacher maximised the school facilities and the time allotted by dividing the class in manageable groups of about 17-20 learners. The researcher participated in two of these sessions; the first was of the learners who had participated and completed the research questionnaires whereas the next attendance was with a different class. The observation was restricted to practical sessions that took part in the computer laboratories. IT being a largely practical subject; a lot of learning was expected to take place in the laboratories. More so, it was possible to monitor and see whether indeed the learners struggled to practise the concepts taught in class as a means of determining the efficacy of the class learning approaches and the teaching methods employed by the teacher. More so, this provided a good opportunity to observe and learn more about the school's ICT infrastructure and the manner in which the school used the current infrastructure to aid the teaching and learning process. Ultimately, the observation exercise was important in supplementing the empirical information in order to further develop an understanding of the teacher's teaching methods, the learning methods and the general school integration of ICT.

Based on the non-participant observation, the following was apparent:

- The target school had a well-developed ICT infrastructure. This was evident from the ratio of computers in the computer lab available to participating learners. The state of hardware of most of the computers was up to date as judged by the process, speed, storage capacity and sleek design of the hardware. Demonstrations in the laboratories were done using giant projectors and the same projectors were applied in class teaching. The teachers were also well resourced with almost every observed teacher having a laptop, a tablet or both of these gadgets;
- The laboratories were clean and neat. There was a staff member in charge of the computer laboratory, which suggested that the computers were also well

maintained. There was network office and dedicated network personnel. He was housed in the computer laboratory. His responsibilities included maintaining the network and resolving any network issues witnessed in the school system;

- The computer laboratory hardly had any papers or books. This implied that the class is purely practical and that the class materials are stored on the school network. This eliminated the learner need to carry books or referral materials, since they were accessible on demand. More so, this suggested that the learners were comfortable and able to access notes from the school information portal or from the school network. This demonstrated a good knowledge of computer operability by the learners;
- The learners were well organised and the teacher only assumed the role of the facilitator. The ratio of learner to computer was favourable with the computer laboratory having 50 computers where the learner number was hardly 20. This contributed to the high organisation of learners as they entered the computer laboratory and sat on the computers. There was no push and shove as would be expected in a computer with a small number of computers. Every learner appeared to be at ease operating their computer, logging in, accessing their e-mails since some instructions were sent to the learners by the teachers and advice was given on accessing the class notes. The school portal required opening the school website and downloading the class notes. No learner asked for instructions up to this point. The learners performed basic coding. About five learners required the input of teacher #2, and the contact was minimal;
- Toward the end of the class, the teacher asked the learners about their practical lessons. Every learner contributed and the teacher knew every learner's name. The learners voluntarily commented on various issues, which showed a good interaction level between the teacher and the learners; and
- The school has a high-speed internet. The access was limited to basic school applications and websites.

The observations made indicated that the target high school had managed to make IT a mainstay. The teacher had managed to improve the learner attitude and improve their IT proficiency levels. The researcher was able to observe a number of aspects that would be applied in improving the status of IT education in the country. The target high school is one of the few high schools in the country that has been able to implement a reliable

ICT infrastructure and also involved the teachers and learners in the overall view of having a technologically enabled society. Despite the progress, it was clear that there were still many challenges and definitely room for improvement.

4.6 Quantitative data

The quantitative data extracted from the dichotomous questions in the questionnaires were analysed as follow:

Teachers' Responses

Question 1

Gender	Respondents	Percentage (%)
Male	2	67
Female	1	33
TOTAL	3	100

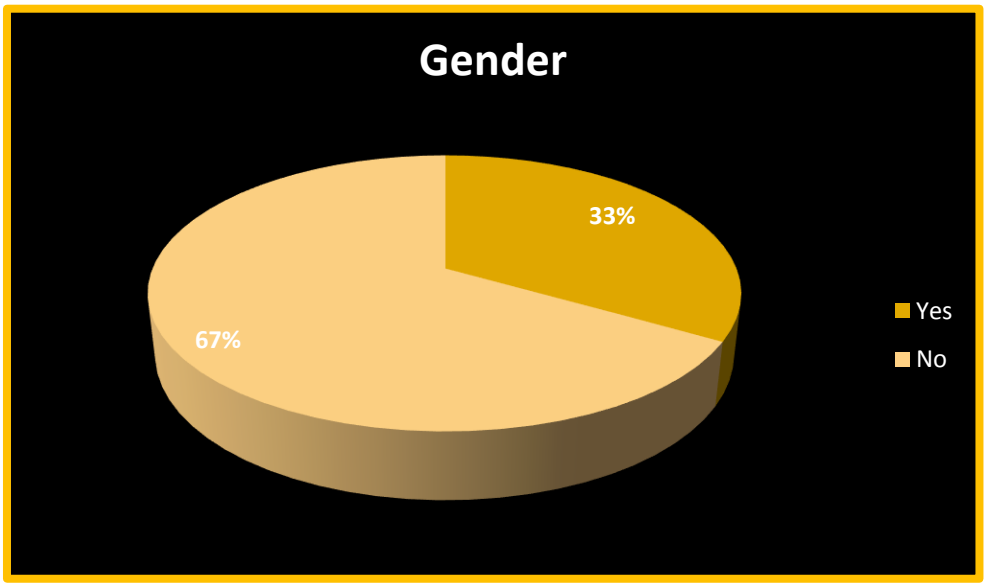

Figure 1

The derived data show that majority of IT teachers in the school are male (67%) while 1 out of 3 is female.

Question 2

Age Group	Respondents	Percentage (%)
18-25	0	0
26-35	2	67
36-45	0	0
46-60	1	33
TOTAL	3	100

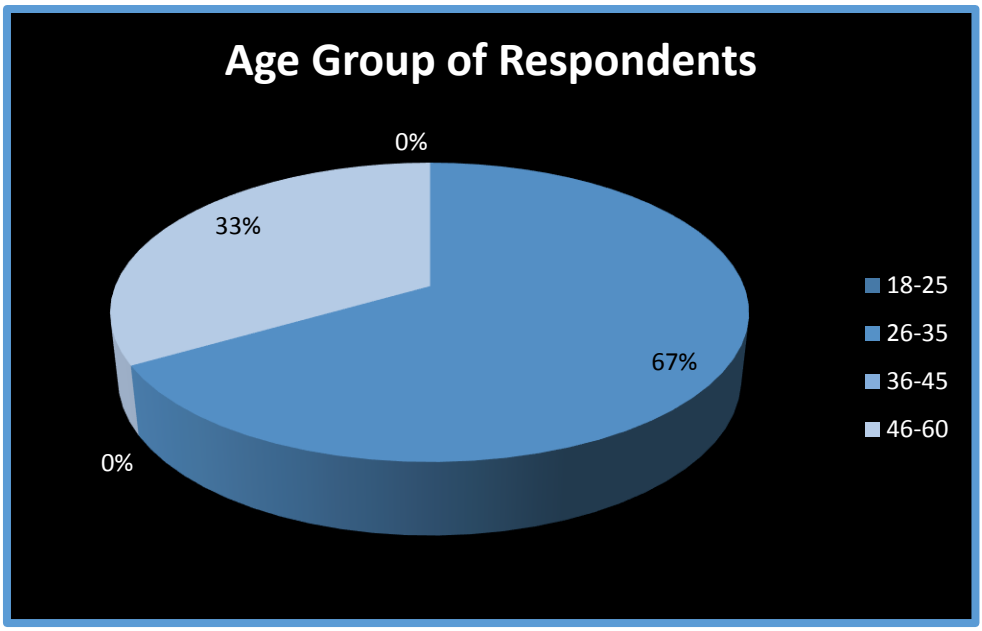

Figure 2

This data illustrates that there are more IT teachers in the age range between 26 and 35 (67%) than any other age group. There is no young adolescent or middle-aged IT teachers in the school. The data mostly implies that there is unequal distribution of IT teachers in terms of age range.

Question 3

Teaching qualification	Respondents	Percentage (%)
Grade 12	0	0
Certificate in Education	0	0
Diploma in Education	0	0
Advanced Certificate in Education	0	0
Bachelor of Education	1	33
Honours Bachelor of Education	2	67
Masters of Education	0	0
TOTAL	3	100

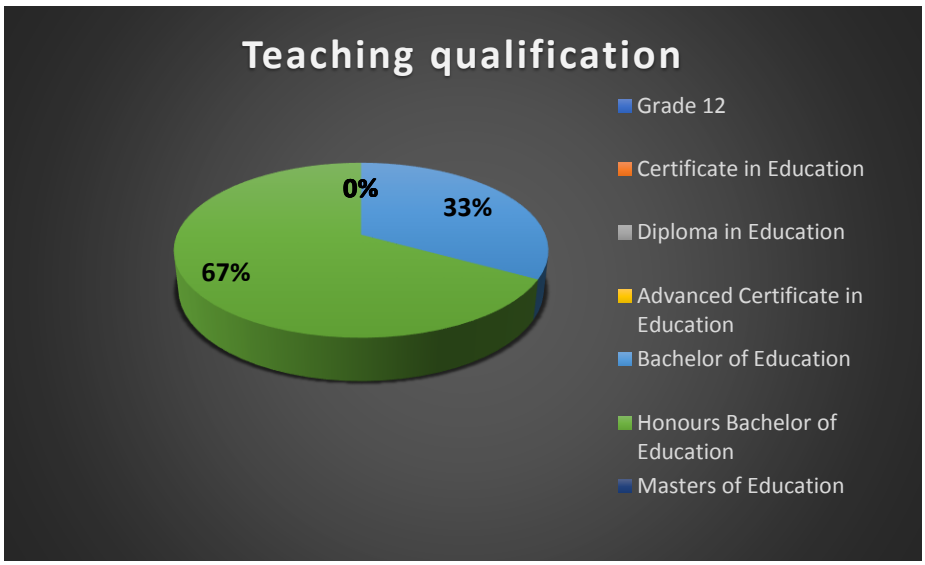

Figure 3

IT teachers in the school are mostly holding honours degree in education and one is holding Bachelor of Education. This signifies that the IT teachers in the school are highly educated and have understanding of teaching skills and the needs of learners.

Question 4

Years in Teaching	Respondents	Percentage (%)
Less than 1 year	0	0
1-5 years	1	33
6-10 years	2	67
More than 10 years	0	0
TOTAL	3	100

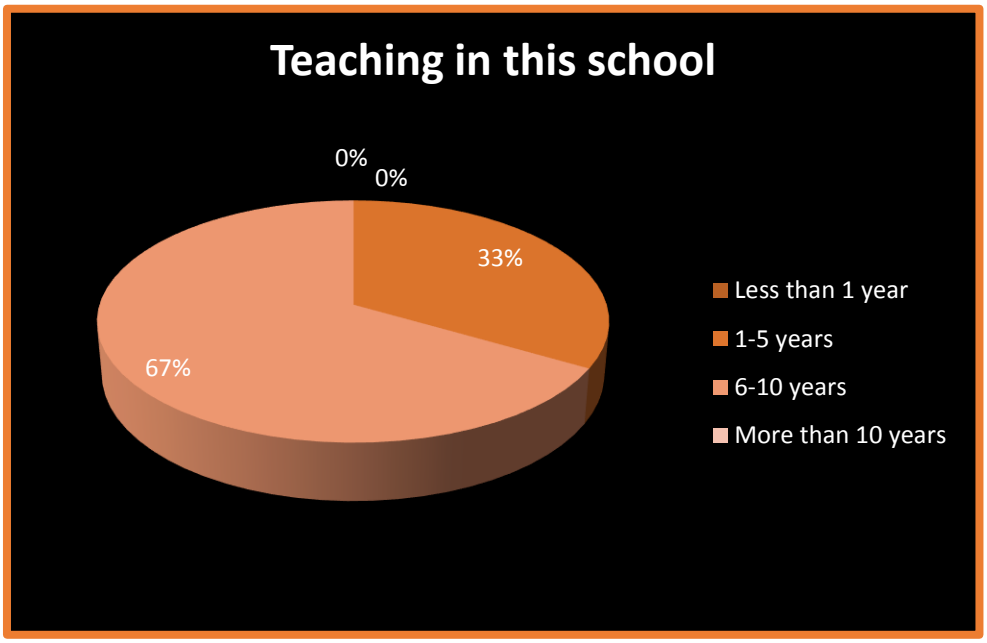

Figure 4

Since no teachers in the school have taught more than 10 years, it can be implied that teachers' relationship with the school and learning environment is not at the strongest. However, since 2 out of 3 teachers have taught in the school for 6 – 10 years, the relationship and understanding of school environment and learner needs is moderately high.

Question 5

IT Teaching in years	Respondents	Percentage (%)
Less than 1 year	0	0
1-5 years	1	33
6-10 years	2	67
More than 10 years	0	0
TOTAL	3	100

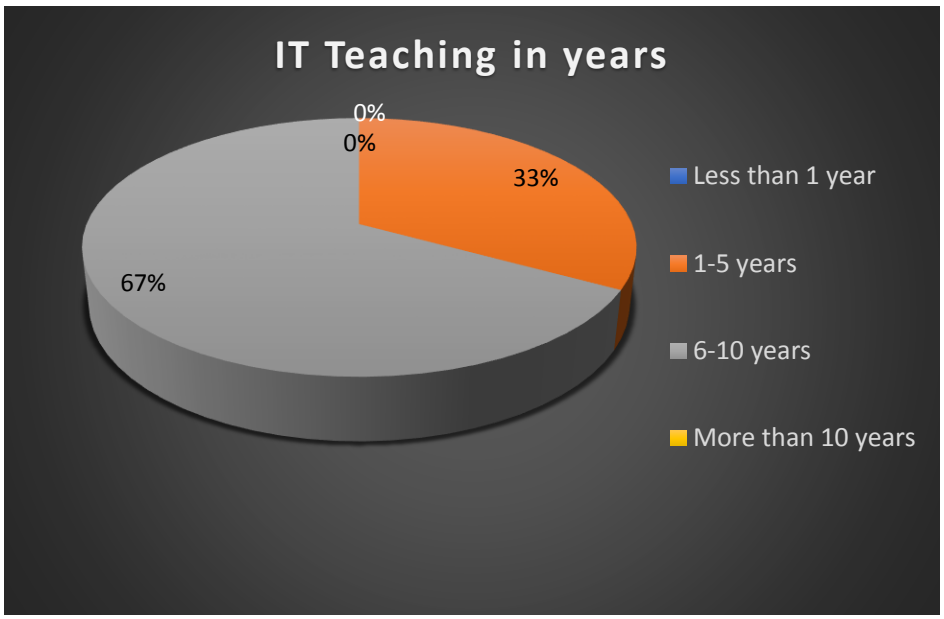

Figure 5

There are high experienced IT teachers in the school (6-10 years), except for one teacher who had thought for less than 5years period. This implies that the school has a number of high experienced and moderately experienced IT teachers. This indicates that teachers may have limited range of learners' understanding in IT learning.

Question 6

Do you have IT background?	Respondents	Percentage (%)
Yes	3	100
No	0	0
TOTAL	3	100

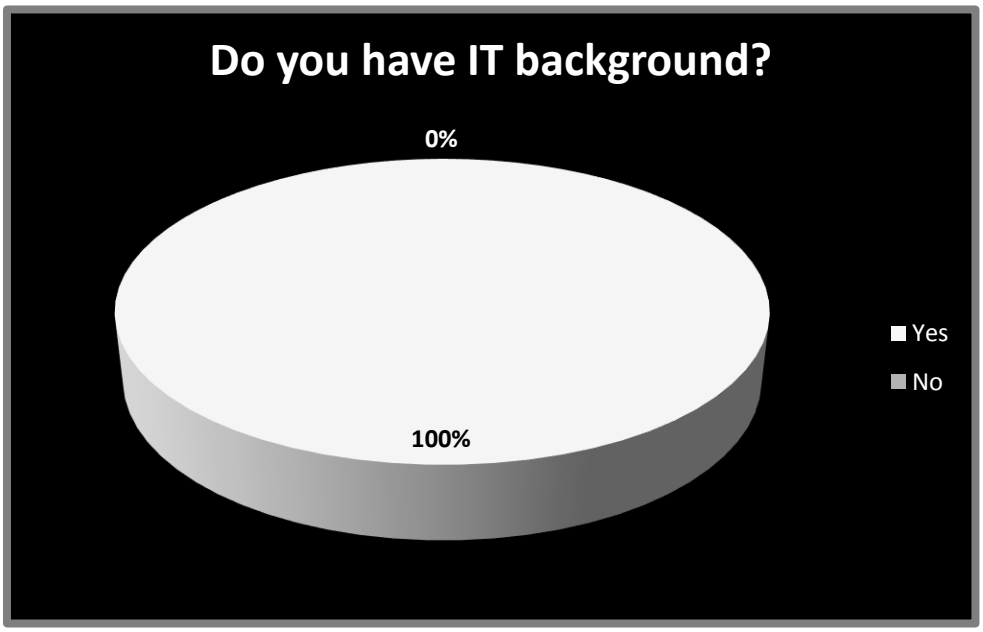

Figure 6

All the sampled teachers have a background in IT signifying that they have deep understanding of IT as a subject. Had there been a teacher with no IT background then their effectiveness as an IT teacher would be superficial.

Question 7

Does the school have Computer Laboratory?	Respondents	Percentage (%)
Yes	3	100
No	0	0
TOTAL	3	100

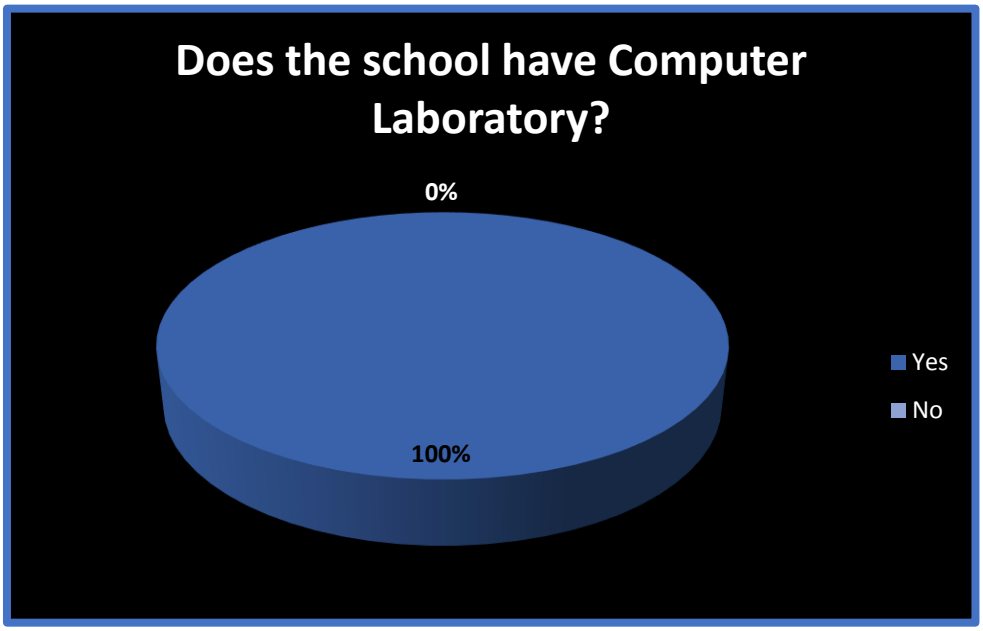

Figure 7

Computers are mandatory for IT education as this subject requires first-hand practical experience of the subject through computer use. Since 100% teachers said that they have computers at school, IT education can be done practically.

Question 8

Number of computer practical classes per term	Respondents	Percentage (%)
1 to 5	0	0
6 to 10	0	0
11 to 20	2	67
More than 20	1	33
TOTAL	3	100

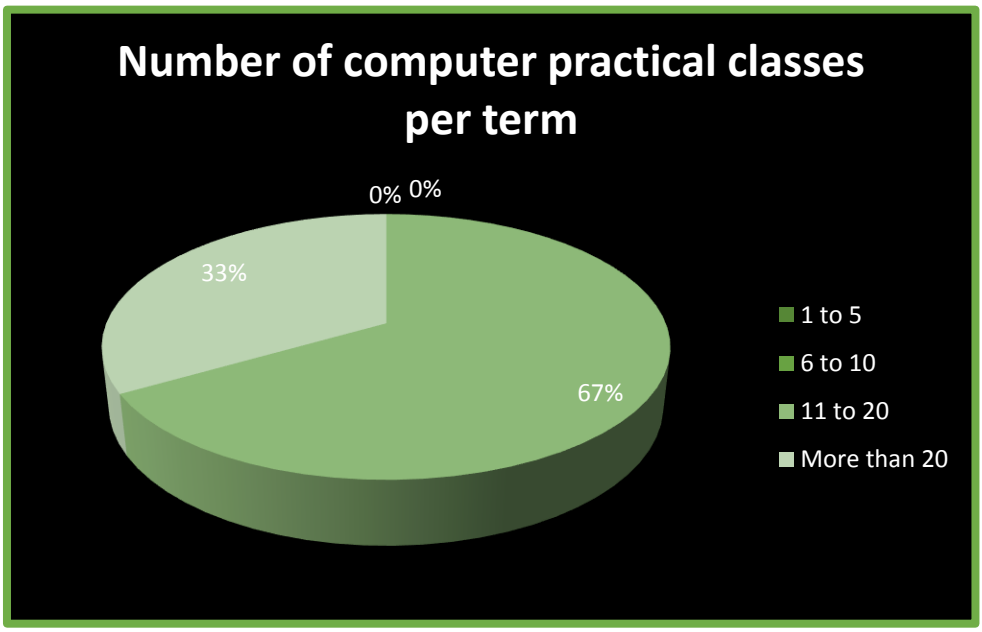

Figure 8

A high number of practical classes show that education of IT is not just limited to theoretical teaching. Since majority of teachers conduct 11 – 20 practical classes per semester, there is a high level of technical and practical based education.

Question 9

Sufficient equipment in school for IT education	Respondents	Percentage (%)
Yes	1	33
No	2	67
TOTAL	3	100

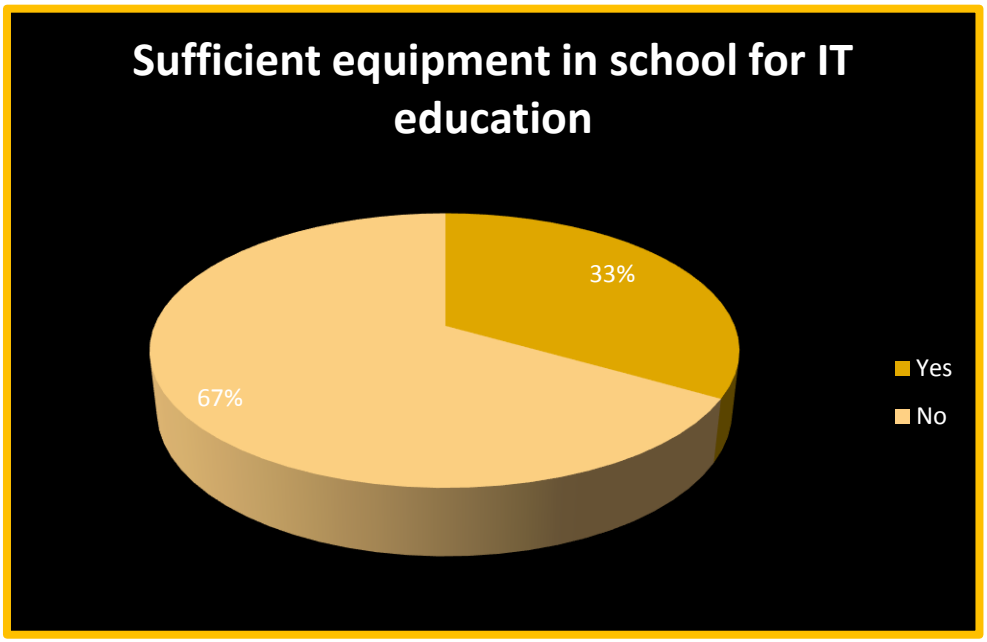

Figure 9

IT teaching encompasses several technical requirements and since 67% of the respondents said that the school does not have adequate equipment, IT teaching and learning is greatly limited.

Question 10

Do you enjoy teaching IT?	Respondents	Percentage (%)
Yes	3	100
No	0	0
TOTAL	3	100

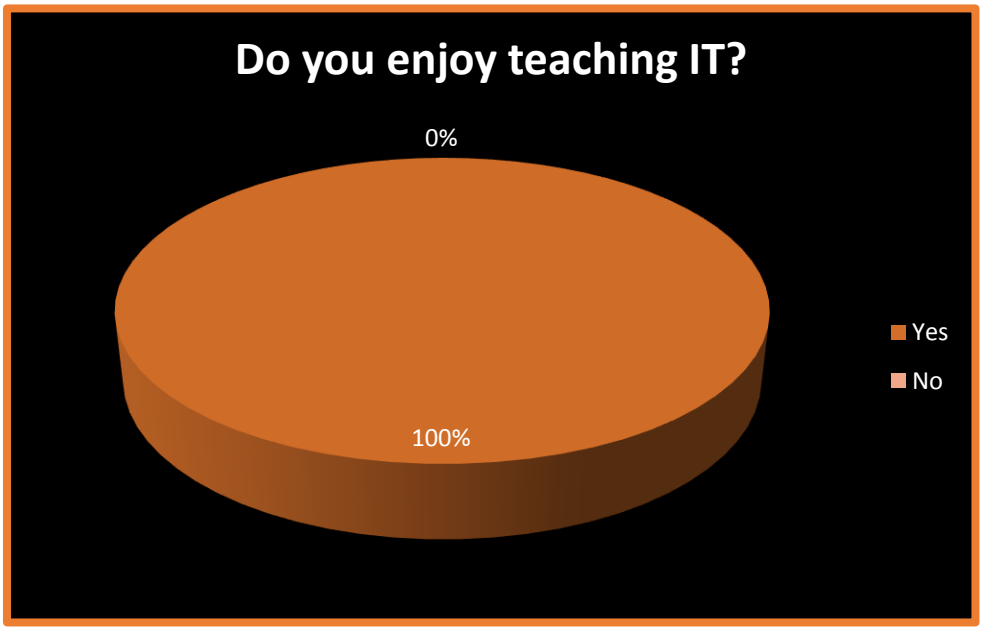

Figure 10

As a teacher, effectiveness of teaching is greatly facilitated by motivation and enjoyment. As 100% of the sample said that they enjoy teaching IT, they are more susceptible to high efficacy levels with learners learning.

Question 11

IT is a difficult subject to teach	Respondents	Percentage (%)
Strongly agree	0	0
Agree	1	33
Partially agree	0	0
Neutral	1	33
Disagree	1	33
TOTAL	3	100

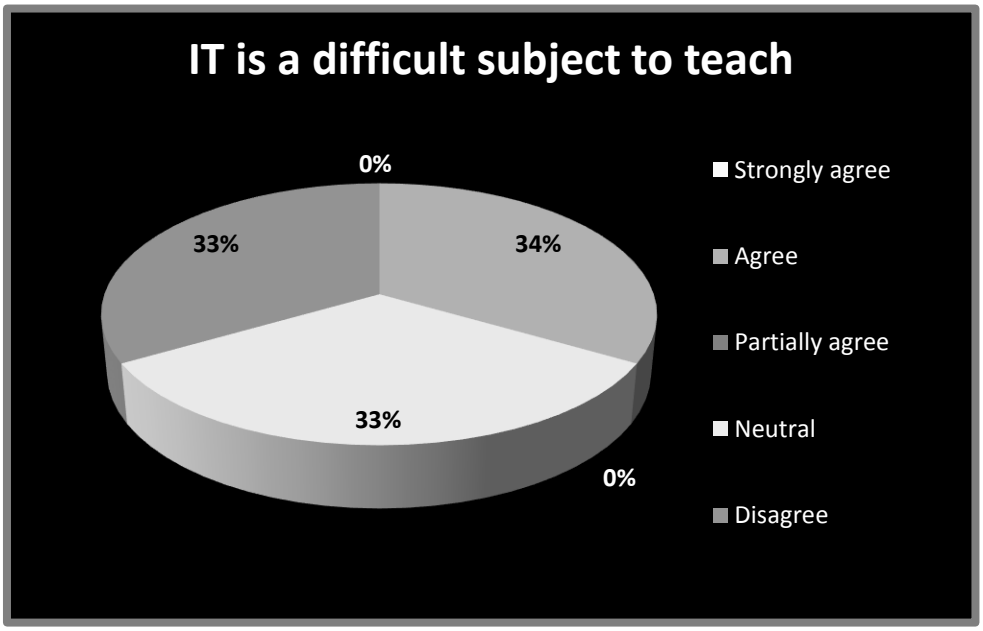

Figure 11

There is equal proportion of teachers agreeing and disagreeing to the statement on IT as a difficult subject. Since only 1 out of 3 teachers agree to this, it can be said that IT is moderately difficult to teach.

Question 12

Do you sustain learners' interest and participation	Respondents	Percentage (%)
Yes	3	100
No	0	0
TOTAL	3	100

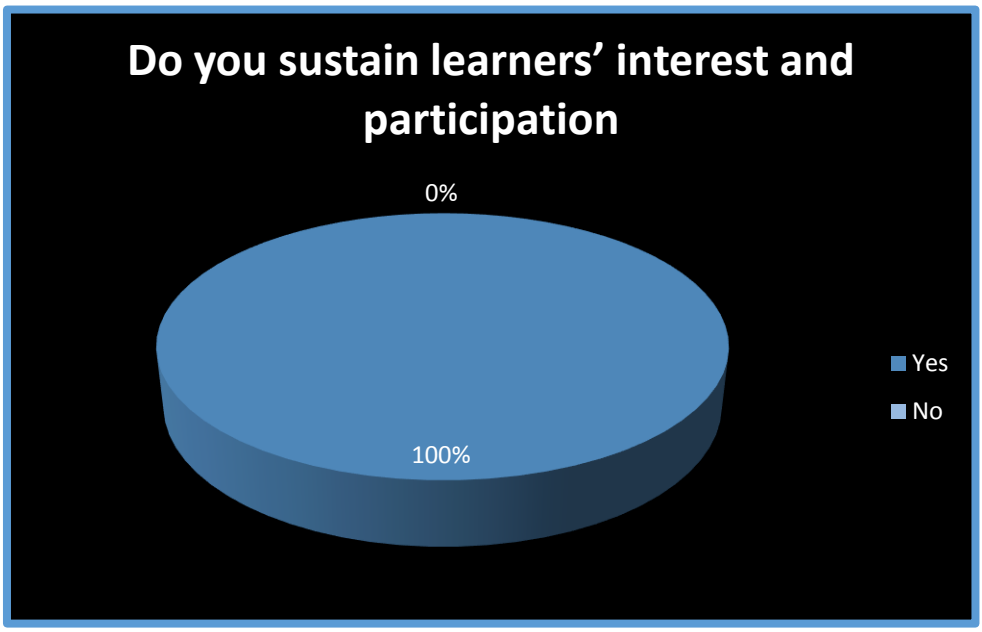

Figure 12

Learners' interest is an essential indicator of high efficacy levels of teaching. Since 100% of the sample sustains their learners' interest, there is a high scope of successful learning within their learners.

Question 13

Do you think IT must be considered as one of the important subjects?	Respondents	Percentage (%)
Yes	3	100
No	0	0
TOTAL	3	100

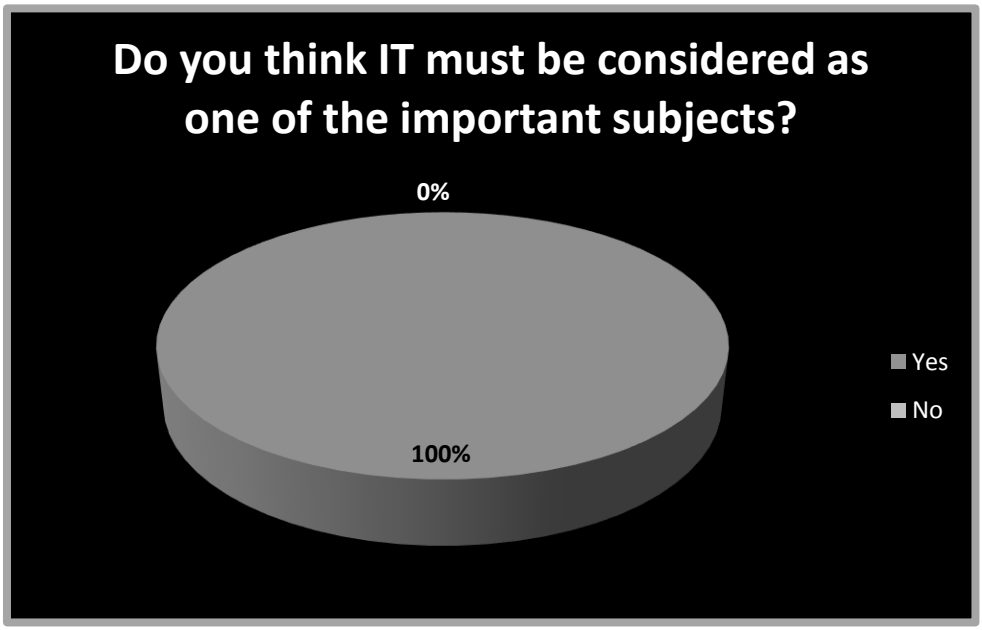

Figure 13

Since 100% of the respondents opine that IT must be considered as one of the important subjects, it can be said that IT teaching should be done more effectively.

Learners' Responses

Question 1

Gender	Respondents	Percentage (%)
Male	15	56
Female	12	44
TOTAL	27	100

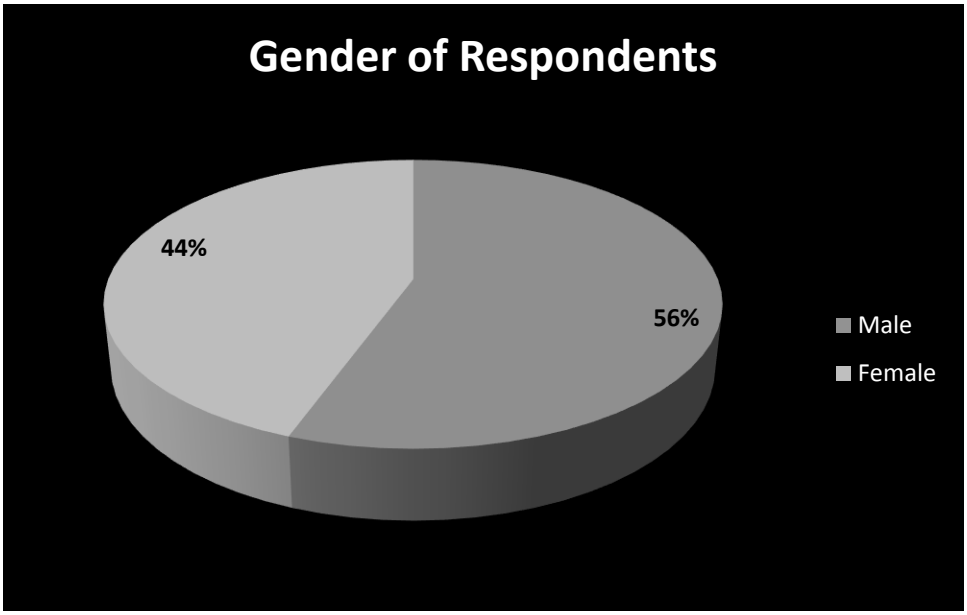

Figure 14

Amongst the sample respondents, there are more male IT learners than female learners (56% and 44% respectively). This does not indicate any gender-based affliction of IT as a subject since the difference between male and female respondents is 3.

Question 2

Age Group	Respondents	Percentage (%)
15-17	12	44
18-20	14	52
21-23	1	4
24 and above	0	0
TOTAL	27	100

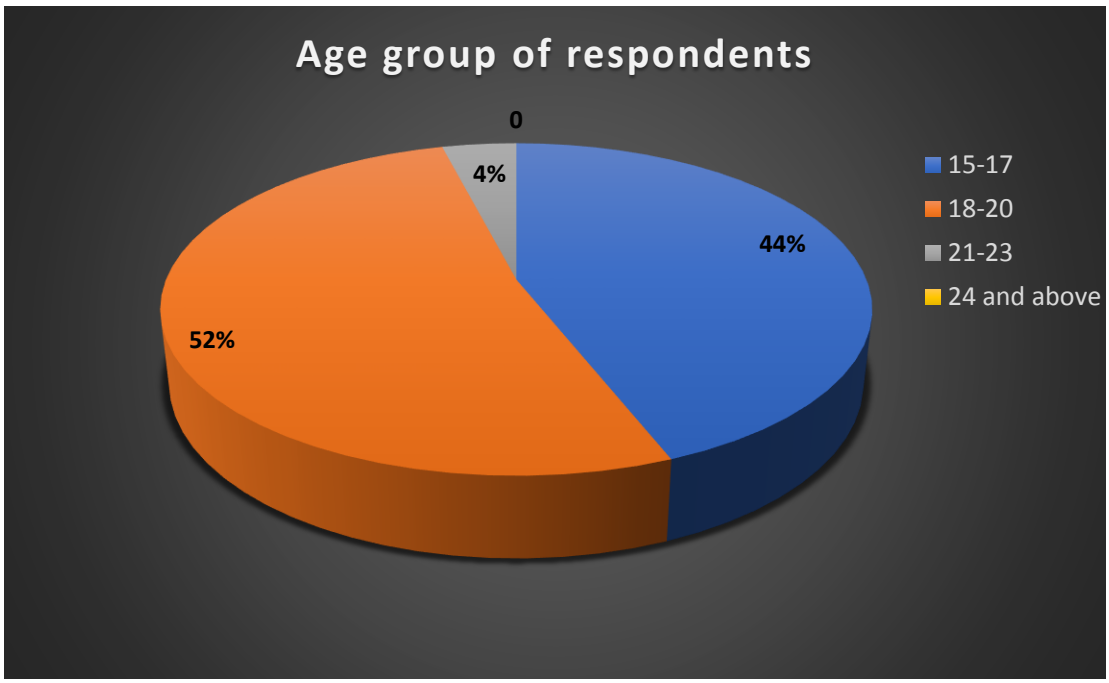

Figure 15

The largest age group of learners from the sample is 18 – 20 indicating that adolescents and young adults are the primary IT learners in the school. Age range of 15 – 17 is a close second and these overall shows that IT learners are primarily rooted to people between the ages 15 and 20.

Question 3

IT as a subject	Respondents	Percentage (%)
Easy	2	7
Boring	5	19
Difficult	20	74
TOTAL	27	100

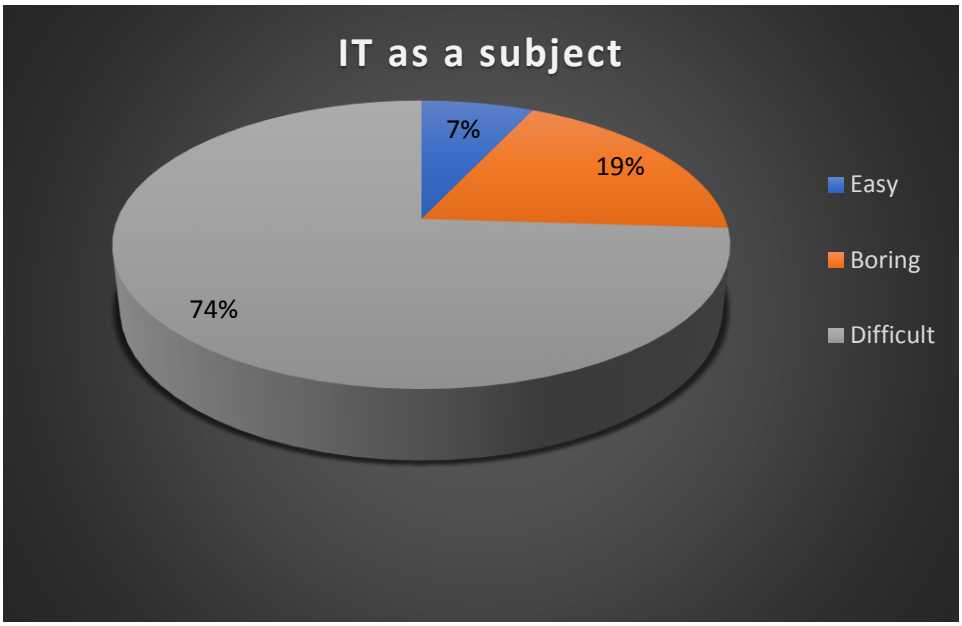

Figure 16

When asked whether IT is easy, boring or difficult, majority said that it is difficult (74%). These indicates two things – firstly IT teaching is limited and teachers are not able to make learners understand the concepts; secondly, learners' past experience with IT limits them to quickly grasp the subject. This indicates the need for more holistic and practical approach to teaching.

Question 4

Do you have interest in IT?	Respondents	Percentage (%)
Yes	22	81
No	5	19
TOTAL	**27**	**100**

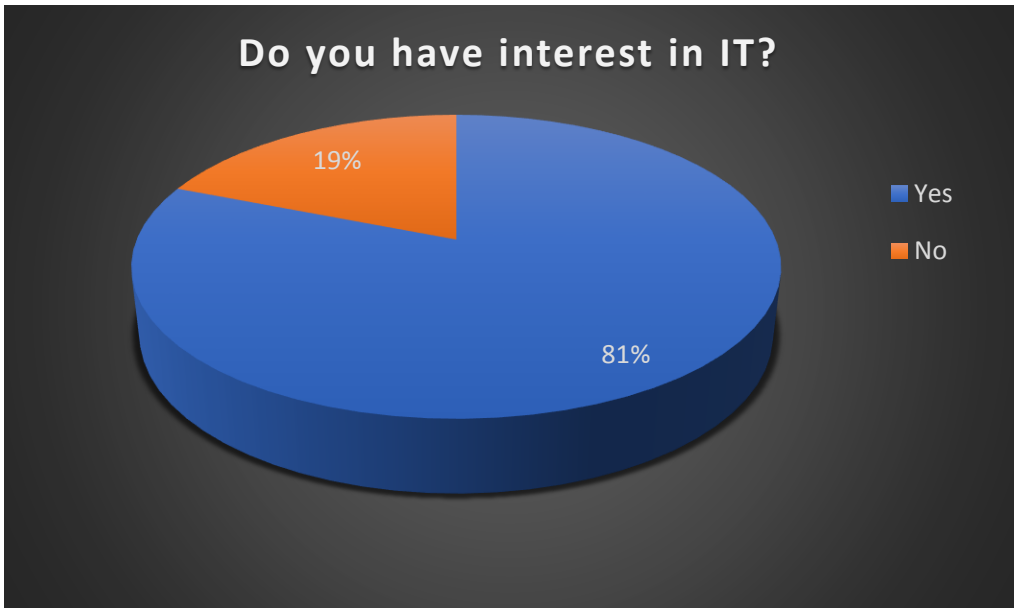

Figure 17

As 22 out 27 respondents are interested in IT, there is an innate motivation within the learners to effectively learn and excel at IT. Since 19% of respondents are not interested, it is essential that learning experience of IT is made more accessible to the entire learning group.

Question 5

Is IT a difficult subject to pass?	Respondents	Percentage (%)
Strongly agree	10	37
Agree	12	44
Partially agree	3	11
Neutral	1	4
Disagree	1	4
TOTAL	**27**	**100**

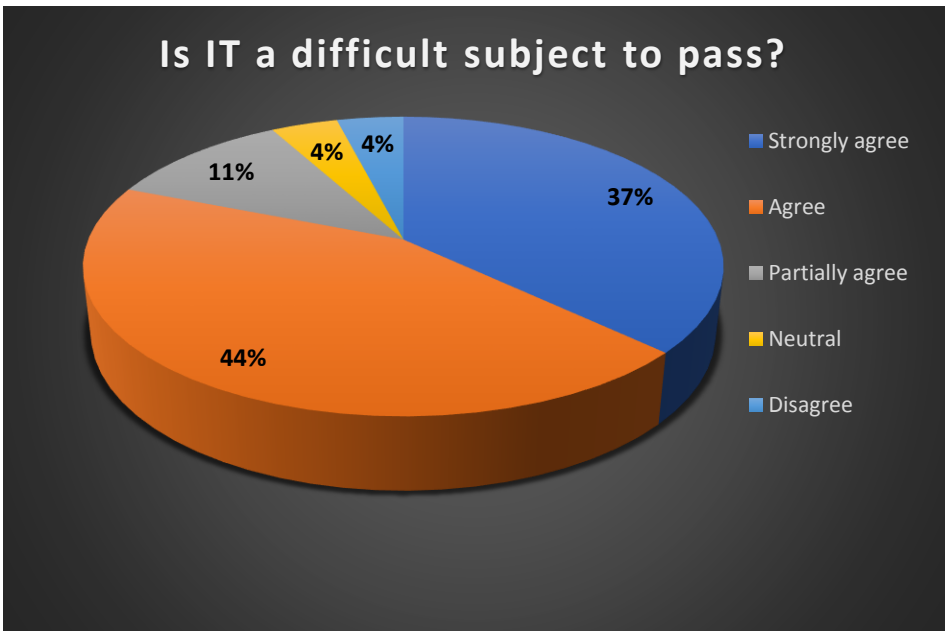

Figure 18

As majority (44%) agree and (37%) strongly agree that IT is difficult subject to pass, it can be interpreted that learners opine the difficulty level of IT is extremely high. This data can also imply that learners note faults or limitations in their teachers' classes indicating that the subject is innately difficult.

Question 6

Does the school have Computer Laboratory	Respondents	Percentage (%)
Yes	27	100
No	0	0
TOTAL	**27**	**100**

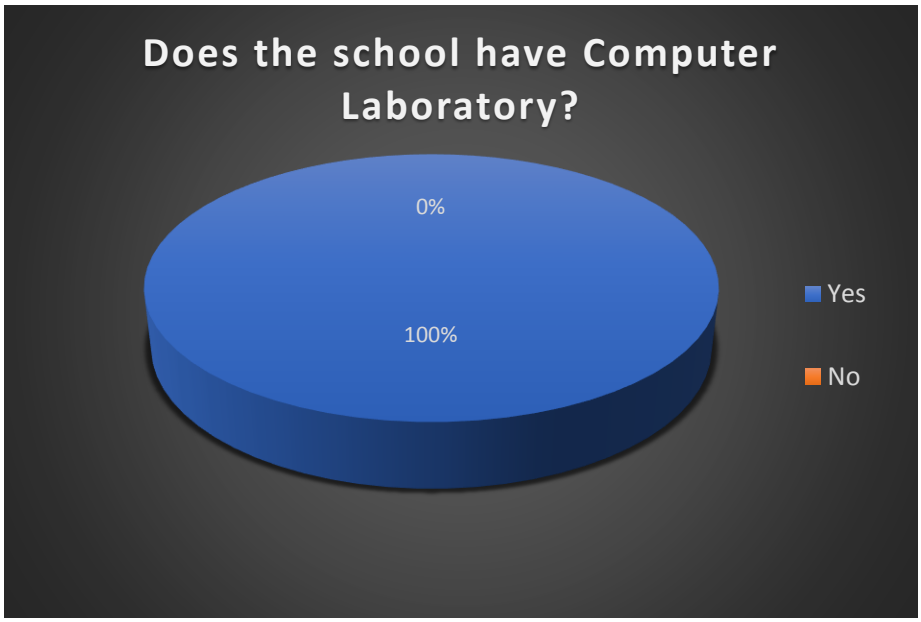

Figure 19

Since all respondents (100%) agreed that their school has computer laboratory, there is proper accessibility for learners in practically learning IT.

Question 7

Number of Computer practical classes per term	Respondents	Percentage (%)
1 – 5	0	0
6 – 10	0	0
11 – 15	0	0
16 – 20	11	41
More than 20	16	59
TOTAL	**27**	**100**

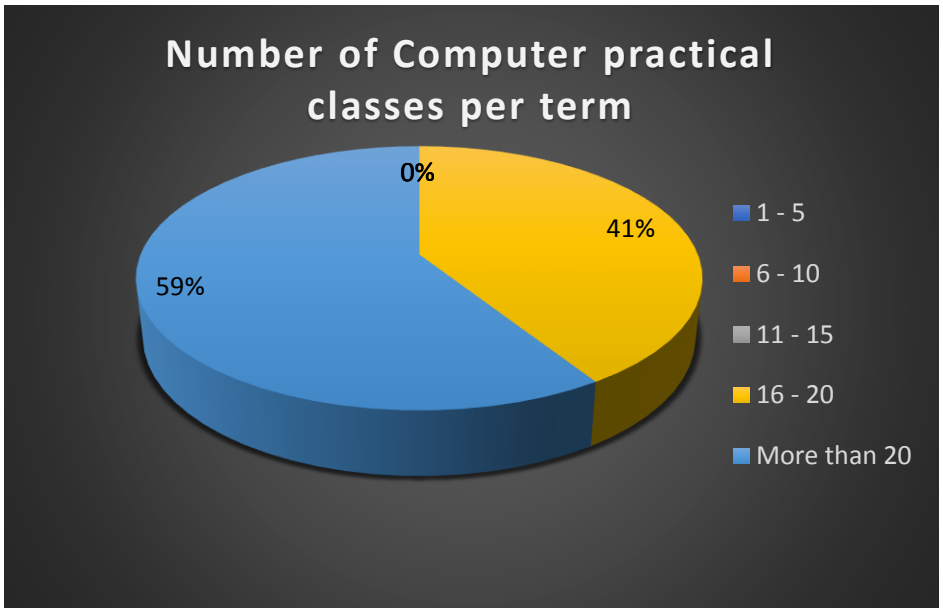

Figure 20

As 59% attend IT classes with more than 20 practical classes and 41% attend practical classes with 16-20 times, their learning experience of IT is highly practical based.

Question 8

Classes or lessons per week	Respondents	Percentage (%)
Once a week	0	0
Twice a week	0	0
Thrice a week	27	100
TOTAL	**27**	**100**

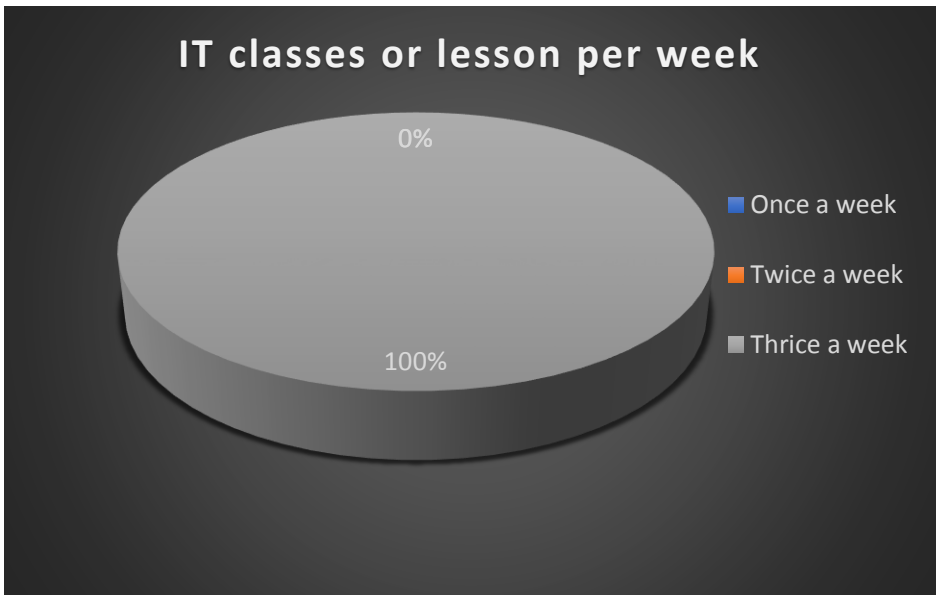

Figure 21

All learners attend IT classes thrice per week which indicate that there is sufficient number of IT lessons and advance in-depth understanding.

Question 9

Sufficient equipment in school for IT education	Respondents	Percentage (%)
Yes	25	93
No	2	7
TOTAL	27	100

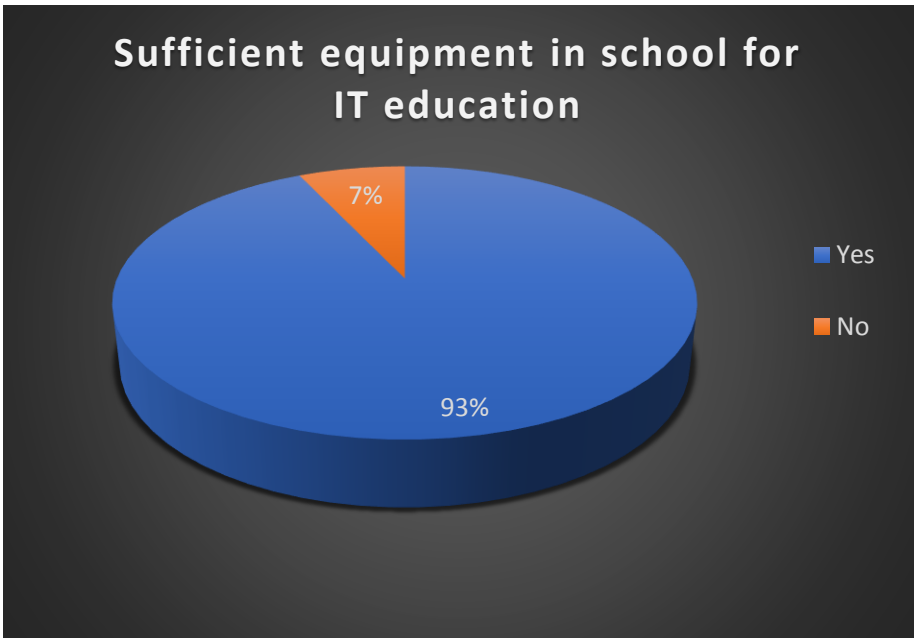

Figure 22

There is sufficient number of equipment for the learners in terms of IT education as 93% opine the same while only 7% oppose this.

Question 10

Sufficient number of IT teachers	Respondents	Percentage (%)
Yes	19	70
No	8	30
TOTAL	27	100

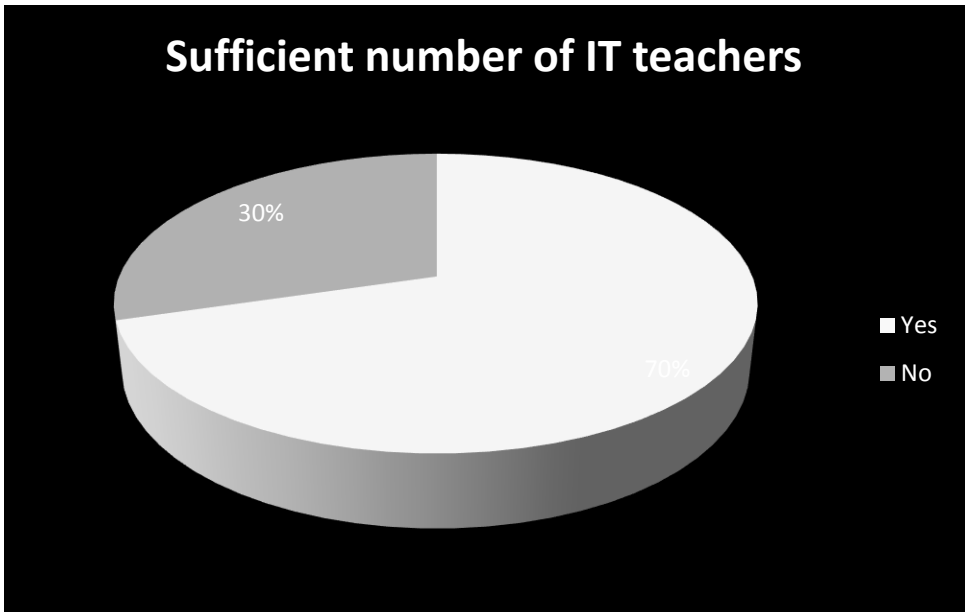

Figure 23

19 out of 27 respondents agree that they have sufficient number of IT teachers in their school indicating that any issues linked to IT teaching within the sample is not due to lack of teachers but other factors such as their approach to teaching and learning environment.

Question 11

Do you prefer IT as a major subject?	Respondents	Percentage (%)
Yes	12	44
No	15	56
TOTAL	27	100

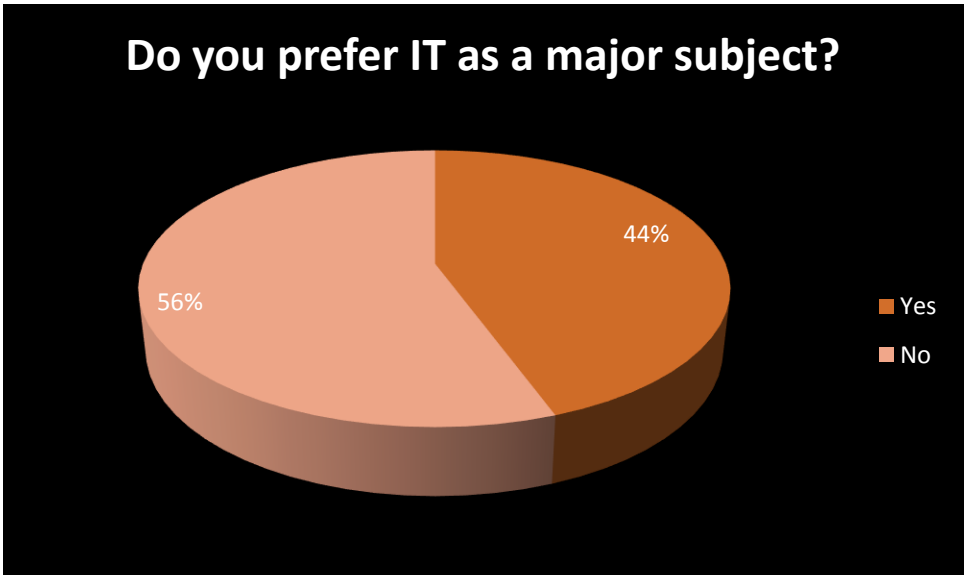

Figure 24

There is almost equal distribution of respondents that prefer IT as a major subject and do not prefer the same (44% and 56% respectively)

Question 12

Do you enjoy IT lessons?	Respondents	Percentage (%)
Yes	13	48
No	14	52
TOTAL	27	100

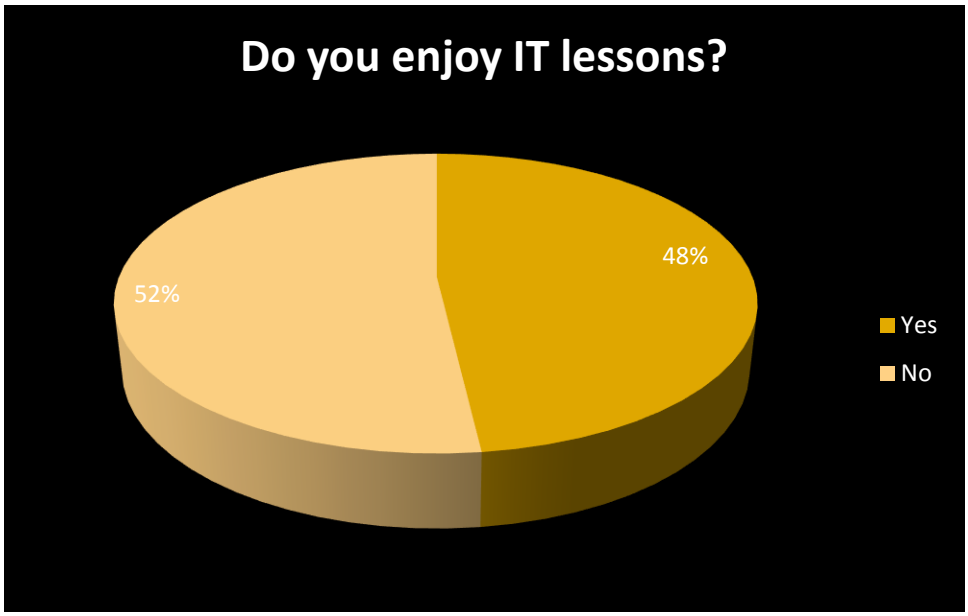

Figure 26

This shows that there is not a significant different between the percentage of people who enjoy and do not enjoy IT lessons. This indicates issues linked to teaching, learning environment and learner motivation regarding the subject.

Question 13

Understanding IT teachers' lesson presentation	Respondents	Percentage (%)
Yes	11	41
No	16	59
TOTAL	27	100

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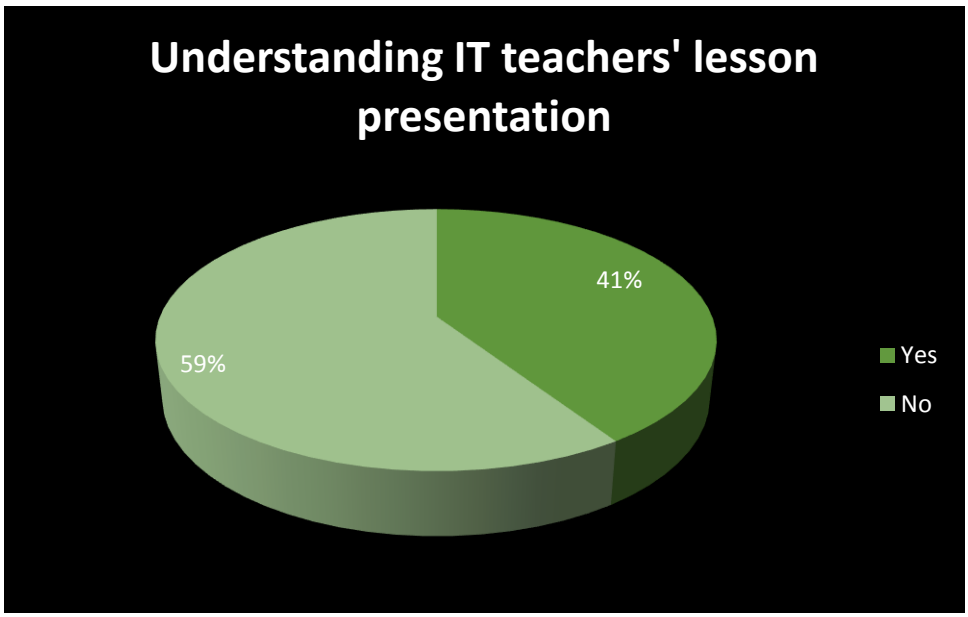

Figure 27

Majority of the learners do not understand their teachers' approaches to presenting IT classes, indicating that teachers may have poor assessment of learners needs. This also indicates that theory and practical classes are not simplified for learners.

Question 14

Do you like the IT teaching methods of teachers	Respondents	Percentage (%)
Yes	15	56
No	12	44
TOTAL	27	100

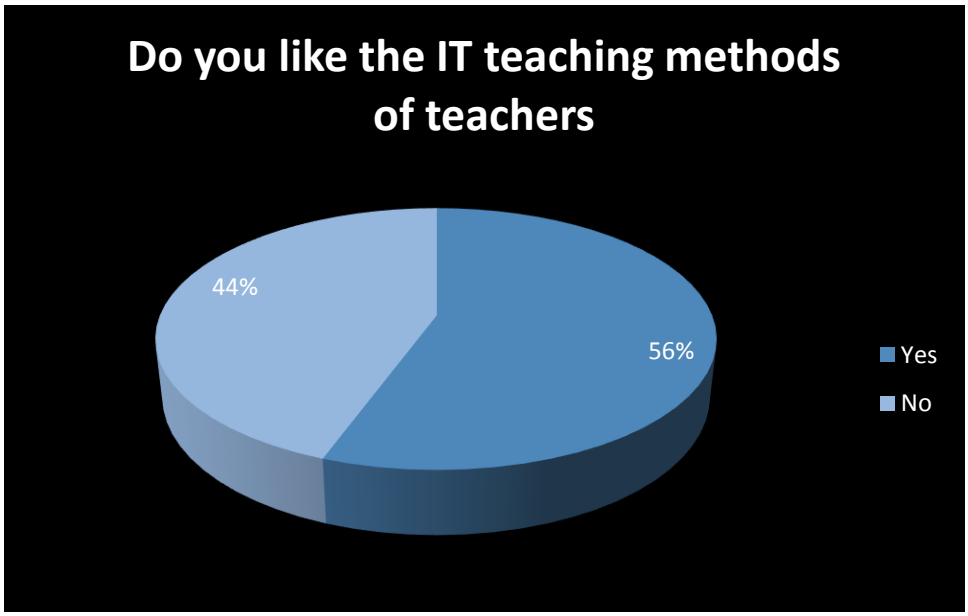

Figure 28

Majority of learners enjoy the methods of teaching employed by their IT teachers (56%). However, this does not indicate high efficacy levels of teachers since 44% do not like the teaching methods.

Question 15

Do you find it necessary for IT teachers to identify different leaning domain of learners?	Respondents	Percentage (%)
Yes	21	78
No	6	22
TOTAL	27	100

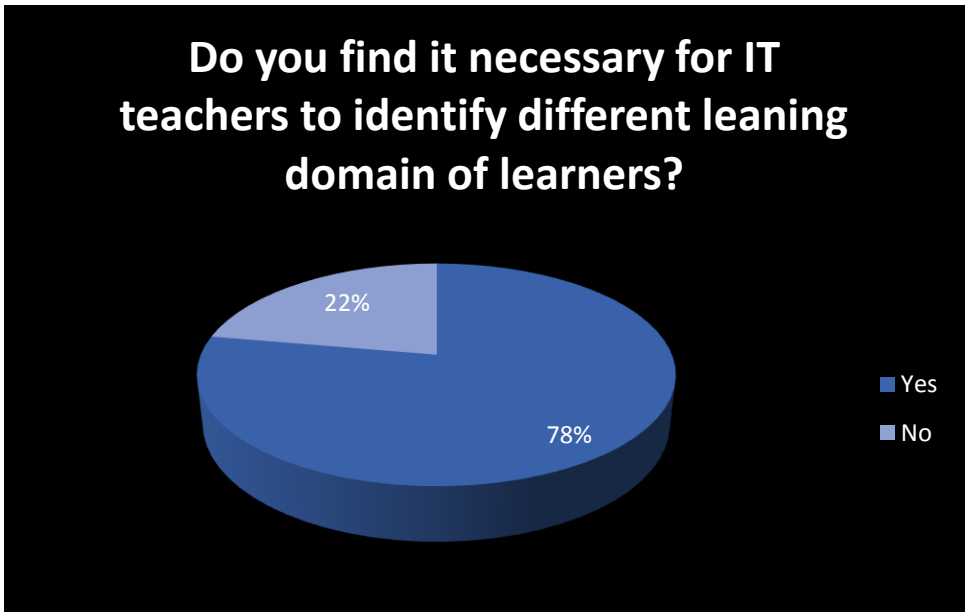

Figure 29

78% of the respondents opine that it is important for teachers to identify leaning domains of learners showing that learners understand the need for individual understanding and that IT cannot be taught generally.

Question 16

Do you like the IT teaching and learning environment in your school?	Respondents	Percentage (%)
Yes	18	67
No	9	33
TOTAL	27	100

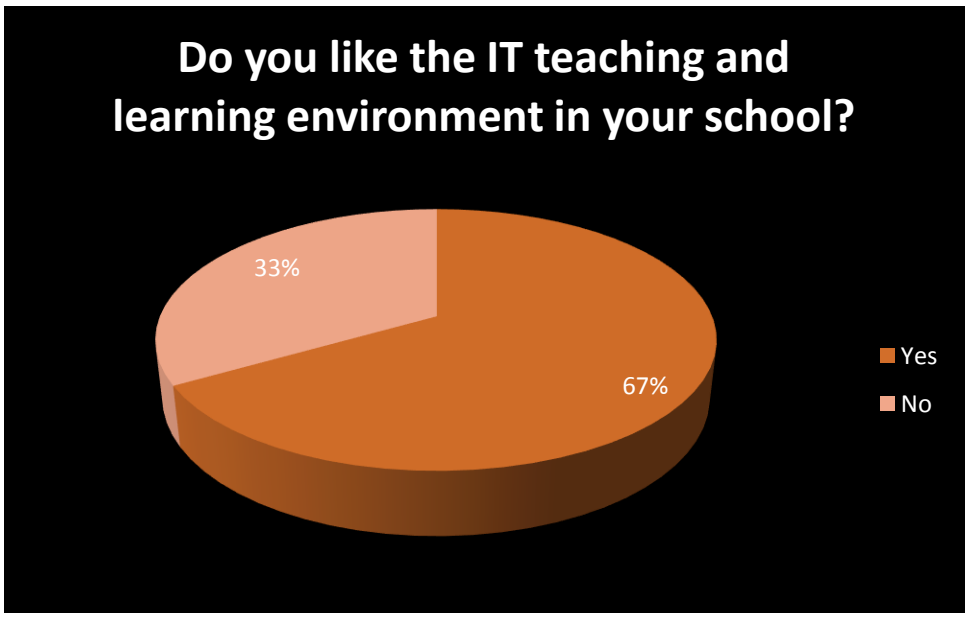

Figure 30

Since majority (67%) like the learning environment of their school, any issues linked to IT learning is rooted to teachers' approaches to presenting IT lessons.

Question 17

Government has a role to play in IT teaching	Respondents	Percentage (%)
Yes	24	89
No	3	11
TOTAL	27	100

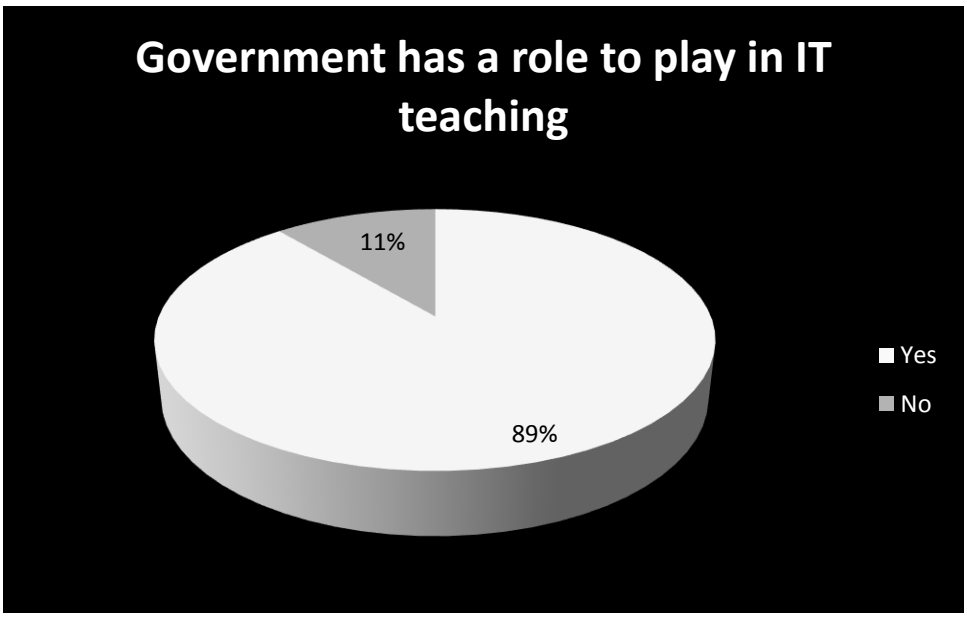

Figure 31

Due to an overwhelming number of respondents (89%) opining that government has a role in IT teaching, it can be said that initiatives taken by government directly help a school in developing an effective IT learning environment.

Question 18

Learners have a role to play in improving IT teaching	Respondents	Percentage (%)
Yes	21	78
No	6	22
TOTAL	27	100

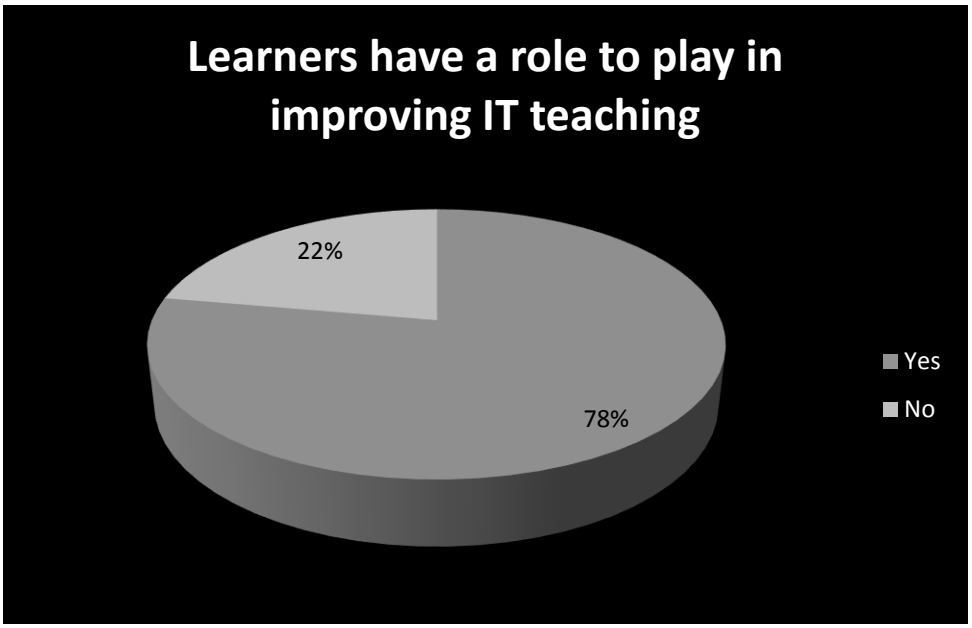

Figure 32

Learners need to be indicative of their needs to teachers and raise doubts for a better learning experience. In this regard, 78% of the respondents agree that they themselves have a role in improving IT teaching.

Discussion

The quantitative data echo the qualitative results. Triangulation occurred.

4.7 EMERGING THEMES

Having conducted interviews, the researcher observed the learner and teacher relationship and activities in class and having gone through the returned questionnaires, the following themes emerged from both the teachers and the learners:

- Teacher-learner interactions,
- creation of education or teaching materials, distribution of teaching materials and learners' numbers,
- teachers' interest, ICT benefits and challenges
- and learner and teacher attitude.

These themes are discussed next.

4.7.1 Teacher – learner interactions

Teacher-learner interaction was noted as an important theme for learners. In the 27 questionnaires returned, 20 learners noted teacher interaction as the most important aspect in facilitating IT learning in class. Further, all the learners gave an average of 7.5 when asked to rank how important teacher interaction and learner participation was in IT learning. The score of 7.5 was a high score underlining the learners' belief that they would learn better and would be more absorbed in the subject if there was unlimited access to teachers. There were no restrictions to what a learner should contribute to class and the teacher encouraged the learner ideas whereas providing insight into the learner ideas and contributions. In terms of teachers, Teacher #2 in an interview noted:

> *One of the challenges when I came here was that learners were reserved. I had to change this and encourage learners to participate and actively interact with me (See Appendix C3).*

Teacher # 2 also commented in the open-ended questions that:

> *Learners take time to adjust to the teachers. Once they understand and connect with them, they become very involved and eager to perform well. They share their ideas and communicate more confidently.*

Teacher#3 said:

IT learners are mostly extroverts and are willing to know more from their teachers, they enjoy every bit of lesson and interact frequently with their teachers.

Teacher#1 commented that:

Learning becomes fun and teachers teach with enthusiasm and passion when there are good teacher-learner interactions in a class.

The teacher noted that there was an obvious improvement in material synthesis and general performance. More so, the learners were more concerned with the practical aspect, always desiring to visit the laboratory as opposed to accessing and revising past exams and assessments to improve their exam score. Teacher #1 and teacher #3 also identified that the success in introducing IT in their respective subjects has been shaped by encouraging learner ideas and this has eased the adoption process.

4.7.2 Creation and distribution of teaching materials

This theme emerged from the questionnaires issued to teachers and the interview with Teacher #2. Based on the questionnaires, the teachers lamented the mechanical nature of IT guides distributed by the DoBE. According to the teachers' response, the material is ignorant of the different learner abilities and is more channelled towards passing standardised examinations as opposed to assimilating relevant IT knowledge and leveraging this to enrich teaching in other subjects (Appendix C3). Teacher #3 stated that, having graduated not so long ago, she found a disconnect between the use and application of IT in tertiary institutions and the materials and content supplied by the Department. This material is largely mechanical and, in some cases, outdated. Given the progress and socio-economic level of the learners in the selected high school, the teachers, #1, #2, and #3 have been forced to develop their own instruction and material on the basis of the vision supplied by the Department. This material is relevant to the target high school situation and also encourages learner participation which is glaringly missing from the Department supplied teaching materials.

Teacher#1 said:

It is imperative to add to the material supplied to enable the learners to be on par of what they are supposed to know. (See Appendix C3)

The learners weighed in on the issue of materials by citing that although material distribution was important, the most effective way was presentation of this material on the course-related portal. This allowed the learners to access it on demand and ask questions through prompt messaging services such as e-mails which learners have been able to develop and learn how to use in the course of learning. Again, this refers to the previous theme of demand of teacher access and teacher-learner interaction.

4.7.3 Learners' numbers

In the interview with teacher #2 who is in charge of teaching IT to Grade 12 learners, he said:

Even though a number of factors were responsible for dismal learner performance, the resources were strained, especially the teacher's ability to cover all learners, because all 40 learners were in the laboratory at the same time (See Appendix C3).

He also said:

High number of learners in a class especially during practical prevent teachers from identifying individual problems of learners and thus affect their performance (See Appendix C3).

This information revealed that the teacher's ability to deliver to the learners was constrained by their ability to monitor progress of each learner during their practical lessons in the computer laboratory. During the researcher's observation and attendance of an in-class session, it was clear that the small learners' numbers allowed the teacher a chance to focus on the progress of each of the learners. This made the learners feel they were participants in the class and not merely recipients of teachers' knowledge. This is because the teacher spent the time with each of the learners and listened to the learners' interest and involvement.

In the questionnaires, 12 learners noted that practising in smaller numbers improved their interaction with the teacher. It also allowed the learners a chance to express their thoughts and intentions in a rather personal manner. They could also communicate their personal challenges and problems. This was important in retaining their interest in the

subject. Therefore, small numbers were seen to encourage teacher-learner contact (Appendix C3).

4.7.4 Teachers' and learners' attitude

In the questionnaires returned by the teachers and in the in the interview by teacher #2 it was obvious that the teacher's attitude was important in developing an effective learning environment. Notably, all the teachers besides teacher #2 did not have elaborate training on IT or ICT application in school. Rather, it was the interest they had in learning and applying IT in their teaching and learning environment that drove them to research, develop materials and engage their learners in learning about and with technology (Appendix C3). Teacher #1 said he never went through any form of IT training; however, his interest in IT and the demands of the school prompted or drove him to enroll in school to learn IT. More so, he has had great interest in applying IT education in improving in class solutions and in teaching his respective subjects. Teacher #3 had the suitable exposure to college education and she developed a passion for technology and its application in teaching languages. The attitude she has developed a keen interest in her learners who are currently using the school's ICT infrastructure to access notes, pose questions and also interact with the teacher and fellow learners.

In regard to learners, the learners noted that their present above average performance has been cultivated in the past year, in Grade 12. This is because they have had the teaching approach altered and the teacher interaction changed. The improved interaction, enhanced instruction and their improved participation in class has improved their attitude and this has contributed to improved performance. As a result, 27 learners involved in the study cited that they were confident of their skills, and were certain of being competitive after living high school. A similar positivity was shown by the teachers who cited that they were certain the learners had all it takes to compete in the global and technologically oriented world.

4.8 INTERPRETATION AND DISCUSSION

According to the analysis done at the start of this study; it was evident that the use of a teaching approach is effective in facilitating assimilation of knowledge. Following the study developed by Adunola (2011) it was evident that a hybrid system that capitalises or combines both methods in the teacher-centered and learner-centered approach is

most effective. Combining a method that encourages the learners to participate in class, which is the case with a learner-centered approach, and a method that focuses on the brilliance and knowledge of the teacher, as is the case with a teacher-centered mechanism, bring the best from both parties. Such a method, identified as a hybrid system encourages learners to be proactive in searching for information and research as opposed to the teacher developing a monopolistic approach to the teaching exercise. At the same time, a hybrid approach also encourages the teacher to maximise their experience and determine the most effective way of developing and imparting knowledge. Throughout this research, Grade 12 learners cited that the change in approach from one where the former teacher had focused on their abilities and relegated the role of learners or students to participants had affected their learning and interest in IT. However, the introduction of teacher #2 and his new methods that encouraged the learners to participate in class had brought about a change in the manner learners perceived the course and had spurred on their interest in IT. According to Adunola (2011) a hybrid system, is functional if what the teacher applies, by encouraging input from learners and leveraging his expertise and knowledge in the field bring out the best from both the teacher and the learner.

In teaching and in developing a proper learning environment, the right attitude from both the teachers and the learners is important. Hart and Laher (2015) identify that teachers in educational situations are critical partners and it is impossible to teach or learn without their full participation and dedication. Hart and Laher (2015) identify that age is a major issue in the level of ICT adoption in schools; the older generation of teachers is unlikely to appreciate or involve ICT in their teaching and learning environments. This is because these had no exposure in ICT environments and did not receive requisite training thence, they continue to apply traditional teaching and learning methods. However, one aspect has altered the orientation of these teachers, the right attitude. Hart and Laher (2015) identify that teachers need to develop a desire to update their skills and perceive the needs of learners and aspire to meet these needs. Attitude is also important in determining the extent to which teachers apply themselves in educating or catering for various learner needs.

Looking at the case of the target high school, the teachers have developed their own instructional materials and are also involved in personal development programmes as is

the case with teacher #1 who is averagely older than the rest of the teachers. Teacher attitude thus emerges as an important aspect in enhancing IT education as it fuels research and curiosity on the needs and demands of the learners and the teacher is dedicated to developing solutions that meet these needs. Similarly, a positive teacher attitude is seen to produce a similar attitude on learners. This has created a desire to learn among learners and each of the 27 learners is certain that they have what it takes to make it in a technologically reliant world. More so, the non-participant observation revealed a positive attitude from the learners. The learners appeared jolly when time for the practical class in the laboratories came. They were organised and one could see the smile on their faces which indicated to the researcher that they were glad to be taking part in the class. Another observation was on class participation. There was free teacher-learner communication. The simple coding exercise presented a challenge to a number of learners; they were not reluctant to ask for teacher#2 to help. The teacher responded enthusiastically and appeared happy to help. These indicators pointed to a cordial and a mutually positive study environment. This would not be the case if either of the parties; the teacher or the learner had a negative attitude. Attitude thus emerges a strong factor in developing or enhancing IT education. IT is a subject that requires constant interaction among the learners especially when it comes to the practical aspect. A poor or negative attitude harbours this connection and this affects delivery and as a result some students lag behind. The target high focused on school interaction of learners and the teacher represented the way a learning environment should be cultured in order to capitalise on the teacher's knowledge and the learners' potential. Ultimately, there is a positive correlation between teacher and learner attitude and IT education, or improved IT learning.

4.9 CONCLUSION

The study revealed the importance of caregiving and the value of expert teachers in sharing specialised knowledge with learners. The fact that learner attitudes play an important role in academic performance, surfaced in the interviews as a crucial factor to consider when designing material for IT. The next chapter discusses the final conclusion on the study.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION

This study set out to determine the methods applied to teach IT in a high school in KwaZulu Natal as a representation of the teaching and learning approaches employed in developing ICT education in South African schools. The idea was to determine the best approach to follow to determine the best approaches to enhance teaching and learning of IT. From the start, the study identified that there were general approaches to teaching that improved the learning environment. This is where both the learners were encouraged to contribute in class and the teachers also took control of the teaching exercise, delivering and sharing his knowledge and experience to the learners. This is driven by a need to improve the preparedness of learners to compete in the modern job market. ICT knowledge is indispensable in modern education whether in high schools and in tertiary institutions. This has been acknowledged by the DoBE. The challenge is that the IT curriculum is not continually updated to reflect current changes, yet this is required due to the dynamic nature of the subject. Therefore, in order to provide relevant knowledge a large burden falls on teachers to develop relevant educational material while pursuing the goals of the government policy documents. This is only possible in certain schools, which have been able to develop an elaborate ICT infrastructure. These schools have also been able to develop a sound teaching fraternity that has the right knowledge, foster personal development and bear the right attitude. As a result, these teachers have invested in a teaching and learning approach that is focused in bringing out the best in their learners. This empirical inquiry has provided evidence on the success of constructivist approach in enhancing IT teaching and learning. This is because the theory encourages learner participation and challenges the teacher to develop a class setting that resembles the actual or relevant environment. This helps the learners to develop a connection between IT concepts in class and the problems and experiences they have in life. The success of ICT education is ultimately to be based on its ability to help learners develop a connection between the subject in class and real-life situations. A hybrid teaching approach based on the constructivist theory is good in delivering this result and

is therefore deemed the method of enhancing teaching and learning IT in school as gathered from an empirical inquiry focused on selected high school.

5.2 Findings in terms of the learning theories

There are three theories that were examined in this study, the behaviourist, the constructivist theory and connectivism. The available empirical evidence has provided evidence on the need to develop the ability of learners to develop their knowledge of IT concepts and application of these concepts in real life. Teacher #2 with whom an exhaustive interview was conducted noted that prior to his joining the school, Grade 12 learners were required to memorise IT concepts for examination purposes. The learners would perform well in class, but performed dismally in practical and in application of these concepts. There was a clear gap between class concepts and the learner experiences. Teacher #2 and the rest of the teachers #1 and #3 were able to alter this approach by demonstrating to learners that technology can be applied to solve their day-to-day challenges. This is clearly visible by the application of the ICT infrastructure in developing class content, in class tutoring, such as use of PowerPoints by teacher #3 in teaching languages as well as the development of an information portal where all the teachers upload class material. More so, the teachers were able to use their knowledge and insight to develop interactive platforms which had again improved the interest and interaction of teachers and learners. According to Brown (2006) the constructivist theory is based on the ideology that learning is a result of interaction between the learner and the environment. Interaction between these variables results in knowledge, the underlying assumption of constructivists is that behaviour is situationally determined. As a result, it is critical that learning takes place in actual or relevant settings and that the selected learning tasks must be congruent with the learner experiences. This explains the importance of having adequate facilities; which has been enabled by grouping of Grade 12 learners into smaller groups that the teacher can be able to monitor progress and connection between class concepts and learner experience. This reveals a connection between the learning tasks and the actual settings. This is important in developing learners to a point where they are able to create novel and situation-specific understanding by applying their experience and knowledge in valid fields to solve present challenges (Ertmer & Newby, 2013). In this case, the constructivist theory provides the most relevant and applicable theory in enhancing IT teaching and learning in the target high school and any other school wishing to have the best outcome from their learners.

Connectivism stimulated the development of new concepts explaining the assimilation of the gains of IT growth globally in the learning process. These new concepts also pose a challenge to the ideation of the researcher. This is because it champions the reliance or use of technology to explain or facilitate the expansion or development of knowledge by leveraging on technology (Siemens, 2008). Thence, it is important to weigh the theory's construct against the available empirical evidence. The main position of the theory is that learning happens or takes place in networks. Learners join these networks and are encouraged to join and actively contribute to the information available in these networks. They are also expected to be active consumers of the information supplied or held in these networks (Duke, Harper & Johnston, 2013). Testing this against the available evidence, it is possible to see some semblance of a network in the target high school's ICT infrastructure. This is because the infrastructure links learners in the institution as well as their teachers. However, there is a challenge in the contribution and generation of information. Grade 12 learners, who were subject to this study, are the most advanced learners in IT in the school. In order for learning or mutually beneficial information exchange to take place, or development of knowledge they must be able to share the knowledge they have gained with a wide range of learners. In this case, this would mean interacting remotely, and through the system with Grade 9, 10 and 11 learners. These have far much limited knowledge on IT compared to Grade 12 learners. There would be obvious dominance by the advanced learners whose overall benefits from the localised network would be limited. There is also a big question on whether Grade 9, 10 and 11 would be able to appreciate the knowledge and shared information supplied by Grade 12 learners.

The connectivism principles appear to envision a global or a wide connection of learners and contributors of knowledge (Goldie, 2016). Such a scale is impossible to achieve in the target high school and even if it was designed it would be redundant especially for the advanced learners who would not necessarily gain from the knowledge or information supplied by learners from lower grades. They would be burdened to supply and retain the knowledge system and this may not necessarily enhance, but repress their contribution to development of IT education. More so, the most efficient model in which connectivism was seen to work was in Stanford University (Siemens, 2008). In this system, the teachers acted as facilitators and were in most cases absent. This would not

work in secondary school or in the case of the target high school where the dependence levels on the teacher are still very high. The learners at this level have not yet become independent learners which is largely seen as a component necessary for the success of the learning process as envisioned or advanced by connectivism as a theory.

Therefore, based on available empirical evidence and the developmental level of the target high school learners, a theory that enables constant interaction between the student and the teacher is most important. More so, even though the overall goal of the IT education in high school is to help learners understand IT concepts and make connections with real-life experiences, which take time. The learners at this level even if they are able to contribute information are not yet able to do so independently and the scale of information, they are able to contribute is shallow. Most importantly, their brains are not fully developed in order to carry different functions envisioned under the connectivism model namely; contribution, assimilation, filtering and constant hunger and ambition to access new information. Given these shortcomings, the researcher remains convinced that the constructivist theory represents the best option of improving IT education in this high school and for all learners at this level. The main reason is the emphasis on caregiving and support by the teacher who is more knowledgeable so that the learners can add to their unique Zone of Proximal Development (ZPD). They will grow at their own pace and learn from the teachers and peers.

5.3 Research questions answered

- What methods of teaching can be employed in the teaching and learning of Information Technology in FET?

It was found in the study that the constructivist teaching approach was the most viable to follow. Supporting learners and listening to their problems are very important in changing negative attitudes. Learners need to progress according to their own unique needs. The teacher needs to be the caregiver who identifies the needs and assists in providing knowledge and help with emotional challenges such as fearing managing Internet material.

- How can active methods of teaching, perceptions and experiences improve the pedagogical skills of teaching in the teaching of IT?

Active engagement of the learners and by supporting the teachers, academic results can be influenced. If teachers can be assisted to supplement teaching material in order to benefit learners, it will help a great deal.

The objectives of the study were reached and the researcher concludes by saying that the role of an equipped teacher in teaching IT learners effectively can never be neglected. The constructivist approach was identified as a very crucial way of approaching learners. The interviews further revealed that there was a lack of study material and information to upgrade the level of the learners' performance. The observations were also very valuable in that all the challenges could be identified and solutions could be proposed.

5.4 RECOMMENDATIONS

The following recommendations are made:

- The first recommendation is based on the outdated curriculum and instruction material supplied to schools. The DoBE needs to develop instruction material on a continuous basis so as to include updates in the ICT field. This is a very dynamic field and materials are likely to be outdated at a much faster rate than any other class subject;
- The DoBE also needs to develop a new curriculum for teacher training institutions. The new curriculum must introduce IT and help educate future teachers on how they can leverage the ICT infrastructure to ease teaching and improve the learning environment;
- The DoBE needs to increase its investment in building the ICT infrastructure in South African schools. The availability of adequate facilities has been identified as an important aspect in enhancing IT education. There should be a favourable distribution of ICT material, both hardware and software in school laboratories where all learners are able to gain necessary exposure;
- The schools should develop departments that encourage or induct teachers who do not have requisite ICT skills to teach ways and means of developing the right skills. The department should also be focused on maintaining the ICT infrastructure, keeping it up to date and doing research on the best ways the infrastructure can be leveraged to ease teaching and learning; and
- The DoBE should collaborate with teachers and school principals to develop efficient and effective teaching and learning methods. The teachers are in constant

contact with learners and this places them in a position to understand learners' needs. Teachers should collaborate with the Department to institutionalise efficient and effective solutions to the challenges seen among learners. In this case, a further analysis of the methods discussed here can be done and a refined approach developed and institutionalised in schools to enhance IT education in schools.

- Grade 12 learners can support each other using the learning domains which was discussed in the chapter 2 of this study.

5.5 CONCLUSION

It has been established that effective use of demonstration method, role play and other methods in teaching of IT has benefited both the learners and the teachers. It has improved learner's involvement and interest in IT as well as their performance in the subject. Effective teaching and learning do not only depend on good lesson plans, well presented lesson and use of teaching and learning materials, but solely depend on teacher's ability to identify the behaviours of learners that affect the teaching and learning process either positively or negatively. A change in attitude on major players above is also necessary in solving the problem under study as well as encouraging learners of Information Technology to be independent to increase their general ability.

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APPENDIX A1: INTRODUCTION AND QUESTIONNAIRE FOR TEACHERS AND LEARNERS

Cover letter for Questionnaire (Teachers and Learners)

Osei-Asiamah Joel
P.O. Box 873
Newcastle
2940
13th April, 2018

Dear Participants,

Cover Letter and Introduction to Questionnaire

I am a student at University of South Africa (UNISA) pursuing a Master's Degree Education. The title of my study is: Investigating Methods That Enhance Teaching and Learning of Information Technology: A Case in Newcastle High School. This is part of the requirements of my degree programme.

I am therefore asking you to take few minutes of your time to complete the attached questionnaire to show your views, opinions about the teaching and learning of Information Technology. Participation is voluntary. You are free to withdraw from participation should deem it right for you. You are assured that all your answers will be treated in confidential manner and will not in any way be identified with you as individual.

Permission to undertake this study has been granted by the Department of Basic Education, KwaZulu-Natal and the Ethics Committee of the College of Education, UNISA. If you have any research-related enquiries, they can be addressed directly to me or my supervisor. My contact details are: 0739936170 e-mails: lordasiamah1@gmail.com and my supervisor can be reached at 0826876644 Department of Science and Technology, College of Education, UNISA, e-mail: RankhumiseMP@tut.ac.za.

Yours sincerely,

Osei-Asiamah Joel

APPENDIX A2: QUESTIONNAIRE FOR TEACHERS

(Please tick the appropriate box and fill in the blank spaces where applicable)

1. Please indicate your gender

   Male ☐
   Female ☐

2. What age category do you fall?

   18-25 ☐
   26-35 ☐
   36-45 ☐
   46-60 ☐

3. Teaching qualification

   Grade 12 ☐
   Certificate in Education ☐
   Diploma in Education ☐
   Advanced Certificate in Education ☐
   Bachelor of Education ☐
   Honours Bachelor of Education ☐
   Masters of Education ☐

4. How many years have you being teaching in this School?

   Less than 1 year ☐
   1-5 years ☐
   6-10 years ☐
   More than 10 years ☐

5. How many years have you being teaching IT?

   Less than 1 year ☐
   1-5 years ☐
   6-10 years ☐
   More than 10 years ☐

6. Do you have IT background?
   Yes ☐
   No ☐

7. Does the school have Computer Laboratory?
   Yes ☐
   No ☐

8. How many times do you do practical with learners in the Computer Laboratory per term?
   1-5 ☐
   6-10 ☐
   11-15 ☐
   16-20 ☐
   More than 20 ☐

9. Do you have adequate instructional materials in the school for teaching IT?
   Yes ☐
   No ☐

10. If No, what have you done about it as an IT teacher?
    .....
    .....
    ……
    ……

11. Do you enjoy teaching IT?
    Yes ☐
    No ☐

12. If yes, reason for your answer
    ……
    ……
    ……..
    ……

13. Do you see IT as a difficult subject to teach?

    Strongly agree ☐
    Agree ☐
    Partially agree ☐
    Neutral ☐
    Disagree ☐

14. Do you sustain learners' interest and participation in IT lessons?
    Yes ☐
    No ☐

15. If yes, how?

    ---

16. What do you think can account for learners' poor performance in IT?
    ……
    ……

……
……

17. What teaching and learning methods do you normally use in teaching IT?

……
……
……
……

18. How often do you vary methods of teaching?

……
……
……
……

19. What can you do to improve teaching and learning of IT if need be?

……
……
……
……

20. Do you think IT must be considered as one of the important subjects?

Yes ☐
No ☐

21. If yes, why

……
……
……

APPENDIX A3: QUESTIONNAIRE FOR LEARNERS

(Please tick the appropriate box and fill in the blank spaces where applicable)

1. Please indicate your gender
   Male ☐
   Female ☐

2. What age category do you fall?
   15-17 ☐
   18-20 ☐
   21-23 ☐
   24 and above ☐

3. How do you rate your understanding of IT as a subject?
   Easy ☐
   Boring ☐
   Difficult ☐

Why?

……
……
……..
……
……..

4. Do you have interest in IT?
   Yes ☐
   No ☐

Why?

……
……
……
……

5. Do you see IT as a difficult subject to pass?
   Strongly agree ☐
   Agree ☐
   Partially agree ☐
   Neutral ☐
   Disagree ☐

6. Does the school have Computer Laboratory?
   Yes ☐
   No ☐

7. How many times do you do practical with learners in the Computer Laboratory per term?
   1-5 ☐
   6-10 ☐
   11-15 ☐
   16-20 ☐
   More than 20 ☐

8. How of often do you attend IT classes or lessons per week?
   Once a week ☐
   Twice a week ☐
   Thrice a week ☐

9. Do you have adequate instructional materials in the school for teaching IT?
   Yes ☐
   No ☐

10. Do you have adequate IT teachers in your school?
    Yes ☐
    No ☐

11. Do you prefer IT as a major subject?
    Yes ☐
    No ☐

12. Do you enjoy IT lessons?
    Yes ☐
    No ☐

13. Do you understand how IT teachers in your school present their lessons?
    Yes ☐
    No ☐

14. Do you like the teaching methods employ by IT teachers in teaching IT in your school?
    Yes ☐
    No ☐

15. Do you find it necessary for IT teachers to identify different leaning domain of learners?
    Yes ☐
    No ☐

16. Do you like the IT teaching and learning environment in your school?
    Yes ☐
    No ☐

17. Do you think Government has a role to play to improve teaching and learning of IT?
    Yes ☐
    No ☐

18. Do learners have any role to play to improve teaching and learning of IT in your school?
    Yes ☐
    No ☐

19. In your own opinion, how do you want IT to be taught?
    ……
    ……
    ……
    ……
    ……
    ……

APPENDIX B: EXAMPLE OF OBSERVATION CHECKLISTS

SCHOOL:
TEACHER'S NAME:
NUMBER OF STUDENT:
LESSON NUMBER:
DATE:

INSTRUCTIONS :1 =Unsatisfactory, 2=Emerging, 3= Proficient, 4= Exemplary

	PREPARATION	**1**	**2**	**3**	**4**
1	Lesson plans according to number of learners				
2	Clear and specific objectives of the lesson				
3	Selection of equipment and materials according to the objectives of the lesson.				
4	Time planning according to the objectives of the lesson and activities presented.				
	TEACHING				
5	Use of teaching techniques or methods according to the objectives.				
6	Meaningful communications between teacher and learners				
7	Learners actively involved in the class				
	CLASS MANAGEMENT				
8	Learners grouped to participate in activities				
9	Use of equipment needed for the class (e.g. Computers, neat and organised use of the board)				
10	Use of appropriate materials needed for the class.				
11	Pace and time management in delivering the lesson.				
12	Ability to deal with occasional classroom management problems.				
	SELF MANAGEMENT				
13	Punctuality				
14	Friendly and respect to learners				
15	Use of body language, gestures, movement and teaching space				
	LANGUAGE USE				
16	According to learners' level				
17	Tone and volume of voice as needed				

APPENDIX C1: INTERVIEW SCHEDULE FOR TEACHERS

1. Please indicate your gender
2. What age category do you fall?
3. What Teaching qualifications do you possess
4. How many years have you being teaching in this School?
5. How many years have you being teaching IT?
6. Do you have IT background?
7. Does the school have Computer Laboratory?
8. How many times do you do practical with learners in the Computer Laboratory per term?
9. Do you have adequate instructional materials in the school for teaching IT?
10. If No, what have you done about it as an IT teacher?
11. Do you enjoy teaching IT?
12. If yes, reason for your answer
13. Do you see IT as a difficult subject to teach?
14. Do you sustain learners' interest and participation in IT lessons?
15. If yes, how?
16. What do you think can account for learners' poor performance in IT?
17. What teaching and learning methods do you normally use in teaching IT?
18. How often do you vary methods of teaching?
19. What can you do to improve teaching and learning of IT if need be?
20. Do you think IT must be considered as one of the important subjects?
21. If yes, why

APPENDIX C2: INTERVIEW SCHEDULE FOR LEARNERS

1. Please indicate your gender

2. What age category do you fall?

3. How do you rate your understanding of IT as a subject and why?

4. Do you have interest in IT and why?

5.Do you see IT as a difficult subject to teach?

6. Does the school have Computer Laboratory?

7. How many times do you do practical with learners in the Computer Laboratory per term?

8. How of often do you attend IT classes or lessons per week?

9. Do you have adequate instructional materials in the school for teaching IT?

10. Do you have adequate IT teachers in your school?

11. Do you prefer IT as a major subject?

12. Do you enjoy IT lessons?

13. Do you understand how IT teachers in your school present their lessons?

14. Do you like the teaching methods employ by IT teachers in teaching IT in your school?

15. Do you find it necessary for IT teachers to identify different leaning domain of learners?

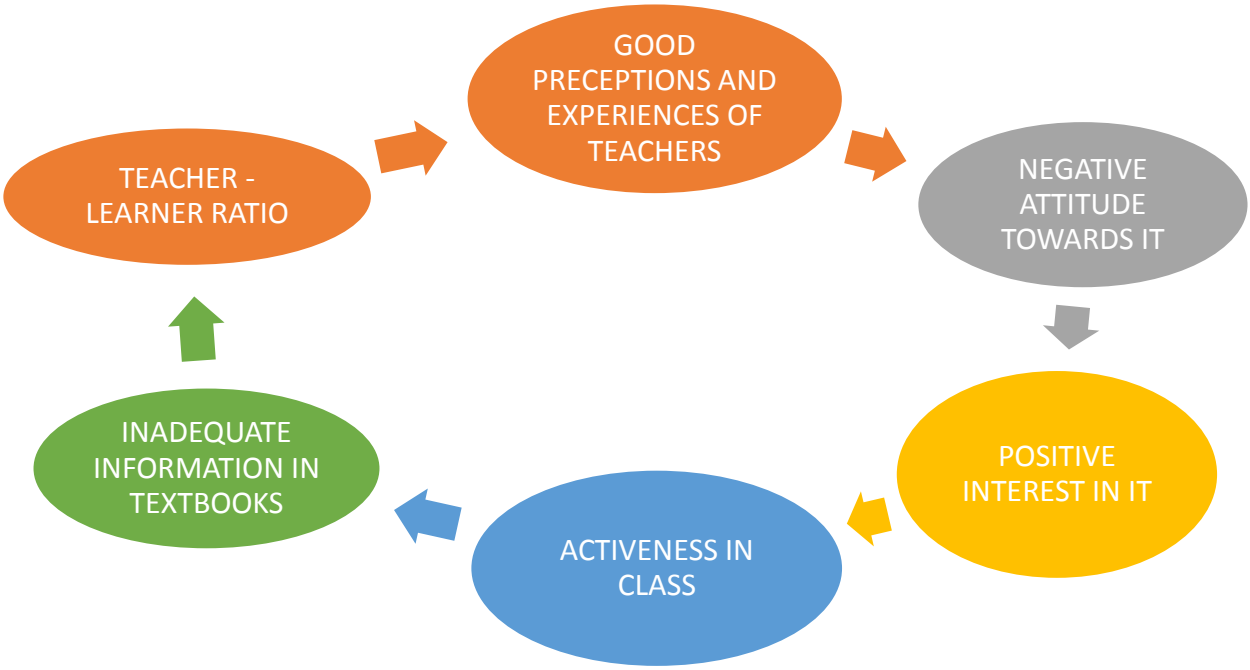
16. Do you like the IT teaching and learning environment in your school?

17. Do you think Government has a role to play to improve teaching and learning of IT?

18. Do learners have any role to play to improve teaching and learning of IT in your school?

19. In your own opinion, how do you want IT to be taught?

APPENDIX C3: CODING SYSTEM REGARDING EMERGING THEMES



APPENDIX D1:

NOTICE TO POSTGRADUATE QUALIFICTION SECTION (M&D)

RESULT : RESEARCH PROPOSAL MODULE

STUDENT NAME	Osei-Osiamah J	STUDENT NUMBER	51233894
DEGREE	MEd	Specialisation	NS

Please indicate the relevant option with an x:

A. **The above student did not comply with the requirements for the research proposal module and may reregister for this module**	
B. **The above student did not comply with the requirements for the research proposal module and may not continue with his studies for the degree.** *Please provide reasons: . . .*	
C. **I confirm that the above student complied with the requirements for the research proposal module** (research proposal approved by departmental higher degrees committee) **and may now proceed to register for the research component**. *Please provide details below*	X

Investigating Methods That Enhances Teaching and Learning Of Information Technology. A Case In Newcastle High School

Supervisor : Dr MP Rankhumise (Contract)

Highest Qualification: PhD

Co-supervisor: N/A Personnel Number: N/A

Highest Qualification: N/A

Address, if external :
(including email)

Additional comments: None

Approval of title by Chair: DHDC: Approved

Approval (CoD)

Comments:

Signature:

Date: 17/4/2018

Comments: Approved

Signature :

On behalf of College/School Executive Committee

Date: 17/4/2018

FOR OFFICE USE ONLY BY SENIOR QUALIFICATIONS

	Result captured (F375)

APPENDIX D2:

UNISA Correspondence
mandd@unisa.ac.za
Thu 2018/04/19 06:13

OSEI-ASIAMAH J MR
P O BOX 873
NEWCASTLE
2940

STUDENT NUMBER : 5123-389-4
ENQUIRIES : MandD@unisa.ac.za

FAX : (012) 429-4150

2018-04-19

Dear Student

I have pleasure in informing you that your research proposal has been approved. Please register and pay online for
the research component of the degree for the 2018 academic year. Registration for 2018 will open on 3 January 2018
and will close on 30 March 2018. Please refer to the Unisa website: www.unisa.ac.za/studentfunding if you are interested
in applying for a postgraduate bursary.

Yours faithfully

for Registrar (Acting)

APPENDIX E1: PERMISSION LETTER TO KZN DEPARTMENT OF EDUCATION TO CONDUCT A RESEARCH IN NEWCASTLE HIGH SCHOOL.

Request for permission to conduct research at Newcastle High School

The title of research – Investigating Methods That Enhance Teaching and Learning of Information Technology. A Case in Newcastle High School

Date- 19th September, 2018

Dr EV Nzama
Head of Department
Kzn Department of Education
Tel: 033 392 1063
Email: Phindile.Duma@kzndoe.gov.za

Dear Dr Nzama,

I, Osei-Asiamah Joel am doing research under supervision of Dr MP Rankhumise (Senior Lecturer) in the Department of Mathematics Science and Business Education towards a M.Ed. at the University of South Africa. We are requesting you to permit us in a study entitled Investigating Methods That Enhance Teaching and Learning of Information Technology. A Case in Newcastle High School

The aim of the study is to put in place possible measures to improve the effectiveness of teaching and learning of Information Technology among Grade 12 learners of Newcastle High. Also, it will consider the importance of Information Technology in education. The research will also look at the Government's role in the teaching and learning of Information Technology. It will look at the various methods in the teaching of Information Technology.

Your department has been selected because KZN has the highest number of candidates writing the final year examinations (Grade 12) in the country since 2000.

The benefits of this study are firstly, the study would make it possible for both learners of Information Technology and teachers of the subject to know the importance of Information Technology in education. It will also increase the effective use of Information Technology in education. It will also serve as a guideline for the IT teachers particularly to know teaching strategies to use and the key players of Information Technology education in Newcastle High.

Furthermore, the findings will serve as a record for the Information Technology department to be used to improve the teaching and learning of Information Technology.

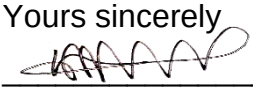
Last but not least, the findings would enable students to know the prospects in Information Technology in order to sustain their interest in the subject.

There are no potential risks involved in this study.

There will be no reimbursement or any incentives for participation in the research.

Feedback procedure will entail a brief summary of the findings, recommendations or full report that will be submitted to the school and Department of Education -KZN, upon completion of this study.

Yours sincerely



Osei-Asiamah Joel

Researcher/Student

APPENDIX E2

education
Department:
Education
PROVINCE OF KWAZULU-NATAL

Application for Permission to Conduct Research in KwaZulu Natal Department of Education Institutions

1. Applicants Details

Title: Prof / Dr / Rev / Mr/ Mrs / Miss / Ms Surname: Osei- Asiamah

Name(s) Of Applicant(s): Joel Email: lordasiamah1@gmail.com

Tel No: _____ Fax: _____ Cell: 0739936170

Postal Address: P.O. Box 873

Newcastle

2940

2. **Proposed Research Title:** Investigating Methods That Enhance Teaching and Learning of Information Technology. A Case in Newcastle High School

3. Have you applied for permission to conduct this research or any other research within the KZNDoE institutions? No

If “yes”, please state reference Number: _____

4. Is the proposed research part of a tertiary qualification? Yes

If "yes"
Name of tertiary institution: University of South Africa

Faculty and or School: Science and Technology Education

Qualification: M. ED Natural Sciences

Name of Supervisor: Dr MP Rankhumise

Supervisor's Signature: _____

If "no", state purpose of research:
_____
_____
_____

5. Briefly state the Research Background___ Newcastle High School is one of the few schools in Amajuba District, Kwazulu Natal that offers Information Technology (IT) as a subject in Grade 10 to Grade 12. This school has an enrolment of over 1500 and has less than 200 learners offering Information Technology (IT). It is one of best schools in Kwazulu Natal with high percentage rate in matric each year but does not perform too well in IT as compared to Mathematics, Physical Science and other subjects regarded as more challenging.

This study is centered to address the matter, specifically investigating on the methods of enhancing teaching and learning of IT in this school.

Information Technology has a major role to play in forming the new worldwide economy to deliver fast changes in the society (Journal of Education and Educational Development, 2017). ICT acts as the foundation stone of contemporary world; thus, understanding this Technology and its fundamental concepts is considered as part of the core of education (UNESCO, 2002). Technology has the potential to renovate the ways of instruction, where and how learning occurs and the roles of students and educators in the instructional process (UNESCO, 2002a).
Educational institutions may utilize ICT to enrich the students with skills and knowledge for the 21st century (Andoh, 2012), such that it can add to worldwide accessibility to education, educational equality, broadcasting of quality teaching learning programs, educators' professional growth and to help in obtaining a more effective educational management. Hence, accessibility, inclusion and standard being the key issues of education, can be comfortably addressed through ICT. ICT improves the standard of education by encouraging learning through ongoing discussion, delayed time discussion, directed instruction, self-learning, critical thinking, data seeking and analysis (Yuen, Law and Wong, 2003). Utilization of ICT can enhance outcomes, instruction, administration and create important abilities in the underprivileged groups (Sharma, 2003), and at the same time influence educational instruction and research process (Yusuf, 2005).

_____

_____

_____

_____

_____

_____

_____

_____

_____

6. What is the main research question(s):

What methods of teaching can be employed in the teaching and learning of Information Technology at Newcastle High School?

Sub questions

1. What is the importance of Information Technology in education?
2. How can active methods of teaching improve the pedagogical skills of teachers in the teaching of Information Technology?

_____

_____

_____

_____

7. Methodology including sampling procedures and the people to be included in the sample:

Mixed methods approach would be used. This is type of research approach in which a researcher combines elements of qualitative and quantitative research approaches (e.g. use of qualitative and quantitative viewpoints, data collection, analysis, inference techniques) for the broad purposes of breadth and depth of understanding and corroboration (Johnson et al, 2007:123).

The mixed-methods sequential explanatory design would also be adopted because of its' popularity among researchers and implies collecting and analyzing first quantitative and then qualitative data in two consecutive phases within one study.

Convenient sample technique would be used to select the participants.

30 participants (3 teachers and 27 learners) will be selected from teachers and learners offering Information Technology in Grade 12.

There are more than 200 learners and 4 teachers learning and teaching Information Technology in Grade 12 respectively. Convenience Sampling will be used to select 30 participants (27 learners and 3 teachers).

_____

_____

_____

_____

8. What contribution will the proposed study make to the education, health, safety, welfare of the learners and to the education system as a whole?

_____

The proposed study is to investigate on the methods that enhance teaching and learning of Information Technology in Newcastle High School but the study would be useful to all institutions in Kwazulu Natal and South Africa as whole.

The study would assist in planning and developing the curriculum of IT as a learning area.

The Department of Education would use this study as a reference in supporting teachers at schools.

Teachers and learners' attitude towards IT would change positively to improve the performance in the subject nationally.

Both teachers and learners would be motivated in the subject and this would increase the number of learners and teachers offering the subject nationwide.

Through this study teachers would have a variety of methods of teaching of IT in schools.

Lastly, the study would help to uplift the image of IT as a subject and would enhance the consideration of the introduction of IT in all schools in South Africa.

_____

_____

_____

_____

_____

_____

_____

_____

KZN Department of Education Schools or Institutions from which sample will be drawn – If the list is long please attach at the end of the form		
Newcastle High School, Amajuba District	Grade 12 learners	30 participants 3 teachers and 27 learners.

9. Research data collection instruments: *(Note: a list and only a brief description is required here - the actual instruments must be attached)***:**

_____

Data collection would be mainly by three data collection techniques, which are Questionnaires, interviews and observation. Questionnaires would be given out to 30 participants first then followed by interviewing 4 participants (1 teacher and 3 learners) and observation of 30 participants (3 teachers and 27 learners) are done.

_____

_____

_____

_____

10. Procedure for obtaining consent of participants and where appropriate parents or guardians:

A letter would be written and sent to the KZN Department of Education Kwazulu Natal Province and Amajuba District to seek permission to conduct the research in Newcastle High School.

A letter too would be written to the Principal of Newcastle High School to seek permission to conduct the research at the school. Finally, a consent form would be handed over to the participants before participating for him or her to agree willingly to participate in the research.

11. Procedure to maintain confidentiality (if applicable): I would maintain privacy and confidentiality of records pertaining to the research by giving the research instruments individually to participants and collecting directly by the researcher from the participants. Names of participants would not be used in anywhere in the research and every data collected would be treated sacred. Study codes may be used on data collection instruments in place of identifying information to protect participants' responses or data when data documents are stored or out in the open.

12. Questions or issues with the potential to be intrusive, upsetting or incriminating to participants (if applicable):

N/A

13. Additional support available to participants in the event of disturbance resulting from intrusive questions or issues (if applicable):

N/A

14. Research Timelines:

15. Declaration

I hereby agree to comply with the relevant ethical conduct to ensure that participants' privacy and the confidentiality of records and other critical information.

I OSEI-ASIAMAH JOEL **declare that the above information is true and correct**

Signature of Applicant _____ **Date** 21/08/2018

16. Agreement to provide and to grant the Kwazulu Natal Department of Education the right to publish a summary of the report.

I/We agree to provide the Kwazulu Natal Department of Education with a copy of any report or dissertation written on the basis of information gained through the research activities described in this application.

I/We grant the Kwazulu Natal Department of Education the right to publish an edited summary of this report or dissertation using the print or electronic media.

Signature of Applicant(s) _____ **Date** 21/08/2018

Return a completed form to:

Connie Kehologile – Tel: 033 392 1004/41
Office of the HOD; KwaZulu Natal Department of Education

Hand Delivered:
Office 318; 247 Burger Street; Anton Lembede House; Pietermaritzburg; 3201
Or
Ordinary Mail
Private Bag X9137; Pietermaritzburg; 3200
Or
Email
kehologile.connie@kzndoe.gov.za /
Phindile.Duma@kzndoe.gov.za
Or
Fax
033 392 1203

APPENDIX E3

education

Department:
Education
PROVINCE OF KWAZULU-NATAL

Enquiries: Phindile Duma Tel: 033 392 1063 Ref.:2/4/8/1629

Mr J Osei-Asiamah
PO Box 873
Newcastle
2940

Dear Mr Osei-Asiamah

PERMISSION TO CONDUCT RESEARCH IN THE KZN DoE INSTITUTIONS

Your application to conduct research entitled: **"INVESTIGATING METHODS THAT ENHANCE TEACHING AND LEARNING OF INFORMATION TECHNOLOGY. A CASE IN NEWCASTLE HIGH SCHOOL",** in the KwaZulu-Natal Department of Education Institutions has been approved. The conditions of the approval are as follows:

1. The researcher will make all the arrangements concerning the research and interviews.
2. The researcher must ensure that Educator and learning programmes are not interrupted.
3. Interviews are not conducted during the time of writing examinations in schools.
4. Learners, Educators, Schools and Institutions are not identifiable in any way from the results of the research.
5. A copy of this letter is submitted to District Managers, Principals and Heads of Institutions where the Intended research and interviews are to be conducted.
6. The period of investigation is limited to the period from 11 September 2018 to 01 March 2021.
7. Your research and interviews will be limited to the schools you have proposed and approved by the Head of Department. Please note that Principals, Educators, Departmental Officials and Learners are under no obligation to participate or assist you in your investigation.
8. Should you wish to extend the period of your survey at the school(s), please contact Miss Phindile Duma at the contact numbers below.
9. Upon completion of the research, a brief summary of the findings, recommendations or a full report/dissertation/thesis must be submitted to the research office of the Department. Please address it to The Office of the HOD, Private Bag X9137, Pietermaritzburg, 3200.
10. Please note that your research and interviews will be limited to schools and institutions in KwaZulu-Natal Department of Education.

Amajuba District

Dr. EV Nzama
Head of Department: Education
Date: 13 September 2018

APPENDIX F

UNISA university of south africa

UNISA COLLEGE OF EDUCATION ETHICS REVIEW COMMITTEE

Date: 2019/02/13

Ref: 2019/02/13/51233894/07/MC
Name: Mr J Osei-Asiamah
Student: 51233894

Dear Mr Osei-Asiamah

Decision: Ethics Approval from 2019/02/13 to 2022/12/13

Researcher(s): Name: Mr J Osei-Asiamah
E-mail address: lordasiamahl@gmail.com
Telephone: +27 73 993 6170

Supervisor(s): Name: Dr MP Rankhumise
E-mail address: RankhumiseMP@tut.ac.za
Telephone: +27 82 687 6644

Title of research:

Investigating methods that enhance teaching and learning of Information Technology. A Case in a high school

Qualification: M, Ed in Science and Technology Education

Thank you for the application for research ethics clearance by the UNISA College of Education Ethics Review Committee for the above-mentioned research. Ethics approval is granted for the period 2019/02/13 to 2022/02/13.

The medium risk application was reviewed by the Ethics Review Committee on 2019/02/13 in compliance with the UNISA Policy on Research Ethics and the Standard Operating
Procedure on Research Ethics Risk Assessment.

The proposed research may now commence with the provisions that:

1. The researcher(s) will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.

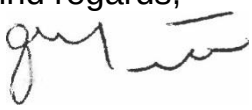
Uneverslty of South Africa
Pc-eller Street. Muckleneuk Ridge, City of Tshwane
PO Box 392 UNISA 0003 South
Africa Telephone +27 1 2 429 3 1 l l Facsimile: +27 1
2 429 50 www.unisa.ac.za

2. Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study should be communicated in writing to the UNISA College of Education Ethics Review Committee.
3. The researcher(s) wilt conduct the study according to the methods and procedures set out in the approved application.
4. Any changes that can affect the study-related risks for the research participants, particularly in terms of assurances made with regards to the protection of participants' privacy and the confidentiality of the data, should be reported to the Committee in writing.
5. The researcher will ensure that the research project adheres to any applicable national legislation, professional codes of conduct, institutional guidelines and scientific standards relevant to the specific field of study. Adherence to the following South African legislation is important, if applicable: Protection of Personal Information Act, no 4 of 2013; Children's act no 38 of 2005 and the National Health Act, no 61 of 2003.
6. Only de-identified research data may be used for secondary research purposes in future on condition that the research objectives are similar to those of the original research. Secondary use of identifiable human research data requires additional ethics clearance.
7. No field work activities may continue after the expiry date 2022/02/13. Submission of a completed research ethics progress report will constitute an application for renewal of Ethics Research Committee approval.

Note:

The reference number 2019/02/13/51233894107/ MC should be clearly indicated on al/ forms of communication with the intended research participants, as well as with the
Committee.

Kind regards,



Prof AT Motlhabane
CHAIRPERSON: CEDU RERC
motlhat@unisa.ac.za

Prof V McKay
EXECUTIVE DEAN
Mckayvi@unisa.ac.za

University of South Africa
Prelier Street. Muckleneuk Ridge. City of Tshwane
PO Box 392 UNISA 0003 South Africa
Telephone; +27 1 2 429 31 1 1 +27 1 2 429 41 50
www.urusa.ac.za

APPENDIX G1: CONSENT/ASSENT TO PARTICIPATE IN THIS STUDY (Return slip)

I, _____ (participant name), confirm that the person asking my consent to take part in this research has told me about the nature, procedure, potential benefits and anticipated inconvenience of participation.

I have read (or had explained to me) and understood the study as explained in the information sheet.

I have had sufficient opportunity to ask questions and am prepared to participate in the study.

I understand that my participation is voluntary and that I am free to withdraw at any time without penalty (if applicable).

I am aware that the findings of this study will be processed into a research report, journal publications and/or conference proceedings, but that my participation will be kept confidential unless otherwise specified.

I agree to the recording of the questionnaires, interviews and observations.

I have received a signed copy of the informed consent agreement.

Participant Name & Surname (please print) _____

_____ _____

Participant Signature Date

Researcher's Name & Surname (please print)

Osei-Asiamah Joel

_____ 19 | 09 | 2018

Researcher's signature Date

APPENDIX G2

LETTER REQUESTING CONSENT FROM PARENTS FOR THEIR CHILD (REN) TO PARTICIPATE IN A RESEARCH PROJECT

Dear Parent

Your son/daughter is invited to participate in a study entitled Investigating Methods that Enhance Teaching and Learning of Information Technology

I am undertaking this study as part of my master's research at the University of South Africa. The purpose of the study is to make it possible for both learners of Information Technology and teachers of the subject to know the importance of Information Technology in education. It will also increase the effective use of Information Technology in education. It will also serve as a guideline for the IT teachers particularly too know teaching strategies to use and the key players of Information Technology education in Newcastle High and these may also be possible benefits of the study.

I am asking permission to include your child in this study because he/she is in Grade 12 offering IT as one of his/her subjects at school.

I expect to have twenty-seven (27) other children participating in the study.

If you allow your child to participate, I shall request him/her to:

Take part in an interview. He /she will be interviewed face-to-face based on the subject at school at an appointed time. Interviews will be conducted formally (structured), questions will be asked verbally and these questions will be focused, clear and encourage open-ended responses.

Complete a questionnaire. Each questionnaire will be accompanied by a letter which explained the purpose of the study and clearly stated that all information that they gave was confidential. Each respondent will be individually informed about the purpose of the

study and anonymity will be emphasised to each respondent. Each respondent will be given ample time to complete the questionnaire in the presence of the researcher. This will give the chance for the respondent to ask for any clarification of the questions when necessary. Furthermore, this will ensure that all questions will be answered as the researcher will personally monitor the completion of each questionnaire.

To be observed at school. Observations will be done thoroughly by regular visit to the school. It will allow for the study of dynamics of situation, frequency counts of target behaviours, or other behaviours as indicated by needs of evaluation. Numerous lessons of Information Technology will be observed to investigate the methods of teaching and learning.

Permission will be asked if videos or audio recordings will be done during the interview, observation and administering of questionnaire.

Any information that is obtained in connection with this study and can be identified with your child will remain confidential and will only be disclosed with your permission. His/her responses will not be linked to his/her name or your name or the school's name in any written or verbal report based on this study. Such a report will be used for research purposes only.

There are no foreseeable risks to your child by participating in the study. Your child will receive no direct benefit from participating in the study; however, the possible benefits to education are that, the findings will serve as a record for the Information Technology department to be used to improve the teaching and learning of Information Technology. Again, the findings would enable learners to know the prospects in Information Technology in order to sustain their interest in the subject.

Neither your child nor you will receive any type of payment for participating in this study.

Your child's participation in this study is voluntary. Your child may decline to participate or to withdraw from participation at any time. Withdrawal or refusal to participate will not affect him/her in any way. Similarly, you can agree to allow your child to be in the study now and change your mind later without any penalty.

The study will take place during regular classroom activities with the prior approval of the school and your child's teacher. However, if you do not want your child to participate, an alternative activity will be available. Other learners from the school offering IT will be contacted to participate.

In addition to your permission, your child must agree to participate in the study and you and your child will also be asked to sign the assent form which accompanies this letter. If your child does not wish to participate in the study, he or she will not be included and there will be no penalty. The information gathered from the study and your child's participation in the study will be stored securely on a password locked computer in my locked office for five years after the study. Thereafter, records will be erased.

There are no direct benefit possible benefits for participants. The data provided by participants will assist the researcher in fulfilling the aim set out in this research study and the study would make it possible for both learners of Information Technology and teachers of the subject to know the importance of Information Technology in education. It will also increase the effective use of Information Technology in education. It will also serve as a guideline for the IT teachers particularly to know teaching strategies to use and the key players of Information Technology education in Newcastle High.

There are no foreseeable potential risks to your child by participating in the study
There will be no reimbursement or any incentives for participation in the research.

If you have questions about this study please ask me or my study supervisor, Prof/Dr MP Rankhumise, Department of Science and Technology Education, College of Education, University of South Africa. My contact number is 0739936170 and my e-mail is lordasiamah1@gmail.com The e-mail of my supervisor is RankhumiseMP@tut.ac.za . Permission for the study has already been given by Department of Education, KZN. and the Ethics Committee of the College of Education, UNISA.

You are making a decision about allowing your child to participate in this study. Your signature below indicates that you have read the information provided above and have decided to allow him or her to participate in the study. You may keep a copy of this letter.

Name of child:

Sincerely

Parent/guardian's name (print)	Parent/guardian's signature:	Date:

Researcher's name (print)	Researcher's signature	Date:
OSEI-ASIAMAH JOEL		19/09/2018

APPENDIX G3

A LETTER REQUESTING ASSENT FROM LEARNERS TO PARTICIPATE IN A RESEARCH PROJECT

Investigating Methods That Enhance Teaching and Learning of Information Technology. A Case in a High School

Dear Learner, Date 27th October,2018

I am doing a study on Investigating Methods That Enhance Teaching and Learning of Information Technology as part of my studies at the University of South Africa. Your principal has given me permission to do this study in your school. I would like to invite you to be a very special part of my study. I am doing this study so that I can find ways that your teachers can use to teach Information Technology better. This may help you and many other learners of your age in different schools.

This letter is to explain to you what I would like you to do. There may be some words you do not know in this letter. You may ask me or any other adult to explain any of these words that you do not know or understand. You may take a copy of this letter home to think about my invitation and talk to your parents about this before you decide if you want to be in this study.

I would like to ask you complete a questionnaire about your subject (IT), I will interview you and observe teaching and learning of IT during school hours. Each of these activities will not take more than 30 minutes of your time.

I will write a report on the study but I will not use your name in the report or say anything that will let other people know who you are. Participation is voluntary and you do not have to be part of this study if you don't want to take part. If you choose to be in the study, you may stop taking part at any time without penalty. You may tell me if you do not wish to answer any of my questions. No one will blame or criticise you. When I am finished with my study, I shall return to your school to give a short talk about some of the helpful and interesting things I found out in my study. I shall invite you to come and listen to my talk.

There are no direct benefit possible benefits for participants. The data provided by participants will assist the researcher in fulfilling the aim set out in this research study and the study would make it possible for both learners of Information Technology and teachers of the subject to know the importance of Information Technology in education. It will also increase the effective use of Information Technology in education. It will also serve as a guideline for the IT teachers particularly to know teaching strategies to use and the key players of Information Technology education in Newcastle High.

There are no foreseeable potential risks to your child by participating in the study

You will not be reimbursed or receive any incentives for your participation in the research.

If you decide to be part of my study, you will be asked to sign the form on the next page. If you have any other questions about this study, you can talk to me or you can have your parent or another adult call me at 0739936170. Do not sign the form until you have all your questions answered and understand what I would like you to do.

Researcher: Joel Osei-Asiamah Phone number: 0739936170

Do not sign the written assent form if you have any questions. Ask your questions first and ensure that someone answers those questions.

WRITTEN ASSENT

I have read this letter which asks me to be part of a study at my school. I have understood the information about my study and I know what I will be asked to do. I am willing to be in the study.

_____	_____	_____
Learner's name (print):	Learner's signature:	Date:
_____	_____	_____
Witness's name (print)	Witness's signature	Date:

(The witness is over 18 years old and present when signed.)

Parent/guardian's name (print)	Parent/guardian's signature:	Date:
OSEI-ASIAMAH JOEL		19 09 2018
Researcher's name (print)	Researcher's signature:	Date:

APPENDIX G4

LETTER REQUESTING CONSENT FROM TEACHERS TO PARTICIPATE IN A RESEARCH PROJECT

Dear Teacher

You are invited to participate in a study entitled Investigating Methods that Enhance Teaching and Learning of Information Technology

I am undertaking this study as part of my master's research at the University of South Africa. The purpose of the study is to make it possible for both learners of Information Technology and teachers of the subject to know the importance of Information Technology in education. It will also increase the effective use of Information Technology in education. It will also serve as a guideline for the IT teachers particularly to know teaching strategies to use and the key players of Information Technology education in Newcastle High and these may also be possible benefits of the study.

I am asking permission to participate in this study because you are teaching in Grade 12 offering IT as one of your subjects at school.

I expect to have 3(three) other teachers participating in the study.

If you accept to participate, I shall request you to:

Take part in an interview. He /she will be interviewed face-to-face based on the subject at school at an appointed time. Interviews will be conducted formally (structured), questions will be asked verbally and these questions will be focused, clear and encourage open-ended responses.

Complete a questionnaire. Each questionnaire will be accompanied by a letter which explained the purpose of the study and clearly stated that all information that they gave was confidential. Each respondent will be individually informed about the purpose of the study and anonymity will be emphasised to each respondent. Each respondent will be

given ample time to complete the questionnaire in the presence of the researcher. This will give the chance for the respondent to ask for any clarification of the questions when necessary. Furthermore, this will ensure that all questions will be answered as the researcher will personally monitor the completion of each questionnaire.

To be observed at school. Observations will be done thoroughly by regular visit to the school. It will allow for the study of dynamics of situation, frequency counts of target behaviours, or other behaviours as indicated by needs of evaluation. Numerous lessons of Information Technology will be observed to investigate the methods of teaching and learning.

Permission will be asked if videos or audio recordings will be done during the interview, observation and administering of questionnaire.

Any information that is obtained in connection with this study and can be identified with you will remain confidential and will only be disclosed with your permission. Your responses will not be linked to your name or your name or the school's name in any written or verbal report based on this study. Such a report will be used for research purposes only.

There are no foreseeable risks to you by participating in the study. You will receive no direct benefit from participating in the study; however, the possible benefits to education are that, the findings will serve as a record for the Information Technology department to be used to improve the teaching and learning of Information Technology. Again, the findings would enable students to know the prospects in Information Technology in order to sustain their interest in the subject.

Neither you nor your school receive any type of payment for participating in this study.

Your participation in this study is voluntary. You may decline to participate or to withdraw from participation at any time. Withdrawal or refusal to participate will not affect you in any way. Similarly, you can agree to allow yourself to be in the study now and change your mind later without any penalty.

The study will take place during regular classroom activities with the prior approval of the school and you as a teacher. However, if you do not want to participate, an alternative activity will be available. Other teachers from the school offering IT will be contacted to participate.

In addition to your permission, you must agree to participate in the study and you will also be asked to sign this letter, a copy will remain with and another with me. If you do not wish to participate in the study, you will not be included and there will be no penalty. The information gathered from the study and your participation in the study will be stored securely on a password locked computer in my locked office for five years after the study. Thereafter, records will be erased.

There are no direct benefit possible benefits for participants. The data provided by participants will assist the researcher in fulfilling the aim set out in this research study and the study would make it possible for both learners of Information Technology and teachers of the subject to know the importance of Information Technology in education. It will also increase the effective use of Information Technology in education. It will also serve as a guideline for the IT teachers particularly to know teaching strategies to use and the key players of Information Technology education in Newcastle High.

There are no foreseeable potential risks to your child by participating in the study
There will be no reimbursement or any incentives for participation in the research.

If you have questions about this study please ask me or my study supervisor, Prof/Dr MP Rankhumise, Department of Science and Technology Education, College of Education, University of South Africa. My contact number is 0739936170 and my e-mail is lordasiamah1@gmail.com The e-mail of my supervisor is RankhumiseMP@tut.ac.za . Permission for the study has already been given by Department of Education, KZN. and the Ethics Committee of the College of Education, UNISA.

You are making a decision to participate in this study. Your signature below indicates that you have read the information provided above and have decided to participate in the study. You may keep a copy of this letter.

Sincerely

Teacher's name (print)	Teachers 's signature:	Date:
OSEI-ASIAMAH JOEL		19/09/2018
Researcher's name (print)	Researcher's signature	Date:

APPENDIX H

Dr C.G.A. SMITH

PhD (English)

Language practitioner: editing and proofreading

Cell: 0727661428

This is to certify that the following document has been language edited:

AN INVESTIGATION OF TEACHING AND LEARNING METHODS IN INFORMATION TECHNOLOGY: A CASE STUDY AT A SELECTED HIGH SCHOOL IN KWA-ZULU NATAL

Authors: OSEI-ASIAMAH JOEL

Nature of the document: Postgraduate work

Date of this statement: 28 August 2019

Smithcga